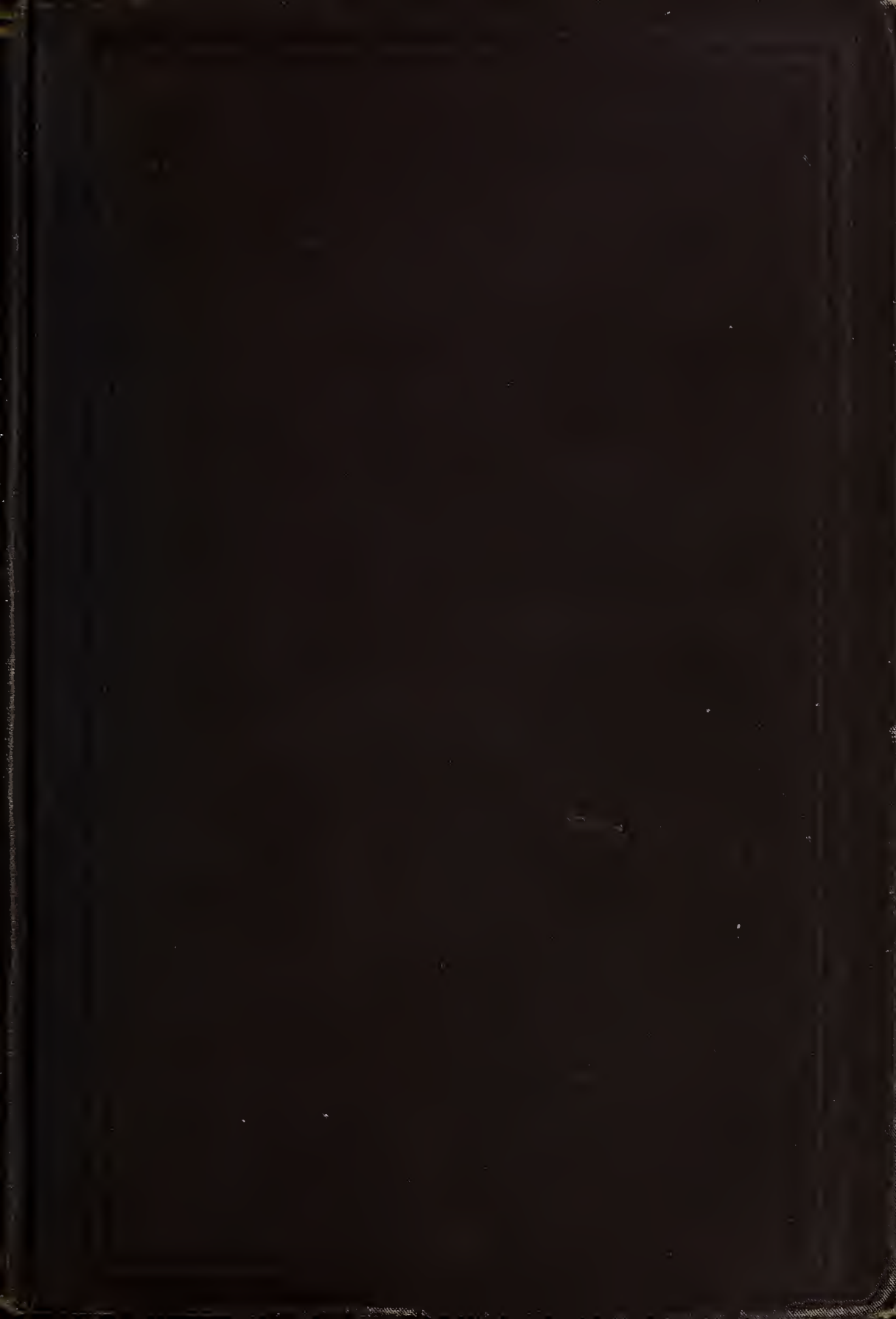






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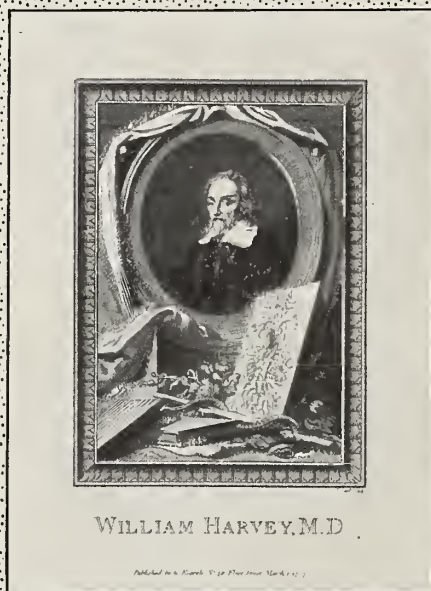
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This photograph of Harvey, the discoverer of the circulation of the blood, is a reduced copy taken from one of a collection of original engravings and medical manuscripts dated 1777.

# DIAGNOSIS BY MEANS OF THE BLOOD

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ILLUSTRATED BY 154 PHOTO-  
MICROGRAPHS OF SPECIMENS  
OF BLOOD, AS OBSERVED IN  
GENERAL PRACTICE, SHOWING  
PRODUCTS THAT ARE FOUND  
IN DEFINITE DISEASES

BY

ROBERT LINCOLN WATKINS, M.D.

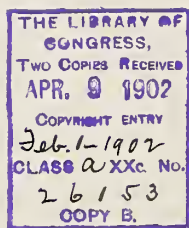


1902

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THE PHYSICIANS BOOK PUBLISHING CO.

NEW YORK AND LONDON



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### DEDICATION.

To my father, GARDNER AUGUSTUS WATKINS, an inventive genius of the class which never recognizes defeat. It was he who, years ago, put medical books into my hands, and said: "Go ahead!"



### PUBLISHER'S NOTICE.

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A once prospective publisher desired the author to suffix various titles and societies to which he belongs to his name.

He refused, however, for he desires the book to sell only on its merits.





## PREFACE.

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This work deals with the examination of fresh or live blood, as American investigators have found it.

It is not intended for the laboratory worker, but for the general practitioner.

In this work the blood is studied as one of the vital organs of the body.

I draw no conclusions, but give the facts as I have found them. In making the examinations described the only apparatus required is an ordinary microscope magnifying 400 diameters.

The cases have of necessity been taken from the writer's own practice, and if the work shall be the means of aiding the physician and promoting a wider interest in all forms of blood examination, the author will feel well repaid.

R. L. WATKINS, M.D.

20 WEST THIRTY-FOURTH STREET,  
NEW YORK, APRIL 1, 1902



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## A WORD IN REGARD TO THE ILLUSTRATIONS.

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These pictures are taken from a collection gathered from an experience of many years. In getting the photograph the patient was invariably present. They are not intended to be specimens of art for the photographic critic. If they were I should have taken them with a photographic objective—a special lens used in all laboratories for taking photo-micrographs.

No photographic lens is used in these illustrations. The lenses employed are—when not otherwise mentioned—the ordinary D (1-6) and E (1-9) Zeiss or the corresponding Leitz objectives.

The time of exposure varies from 30 seconds to 1-200 of a second. They, therefore, probably show details that have not heretofore been recorded.

Many writers, when publishing photographs illustrating their work, cut out the unfocused part of the picture and publish the best. I have reproduced the whole field as exposed.



## INTRODUCTION.

The first question a person asks when he gets sick is: "What is the matter?"

The first thing that a physician asks when he is a little puzzled is: "How am I going to find out?" It is with the intention of being of service to both the patient and doctor that this book has been written.

Many physicians have said to me: "Books and articles written upon new subjects are so full of technicalities and elaborate processes that can be performed only in the laboratory that they are of little interest and of much less value to us."

To overcome this difficulty I have made this picture book so that it will be of service even to the physician of little or no experience in microscopy. I presented an outline of this work and its importance to the American Medical Association at Atlantic City, June 8, 1900.

While a great many of the photographs are taken from advanced cases, others are taken during the early stages of a disease. This was done to make the subject plain; since a more advanced stage of disease is more perceptible to the student and thus more easily diagnosed.

It has been said\*: "Is it not true of disease that one-half the patients seen by the physician are seen far too late? Had those patients been seen earlier, injury could have been prevented. It is a truism that gout exists in the patient's system long before it causes a twinge of pain. He is the greatest discoverer who finds the pre-symptom or symptom of the symptom."

"There are a hundred known intimations or auras of oncoming disease, but there are a thousand undiscovered ones, pre-symptoms, advance scouts and forerunners to be learned, when the slight and unconscious departures from a normality are studied by examinations of the supposably well."

It may be that the author refers in his first statement, or

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\* See Bibliography.

rather in the first two statements, to slight subjective or objective premonitory symptoms. But in regard to gout he certainly does not; or if he does, we feel warranted in stating that there are crystals and other conditions in the blood that show this disease years before symptoms manifest themselves elsewhere. And those who peruse these pages will perceive that not only are the above statements true, but that it is also true that in the blood lies more disease as well as more premonitory symptoms of disease than can be found in any other part of the body.

The quotation goes on: "Pathogenesis, not therapeutics, is the ultimate study of all medicine. And all pathogenesis is by no means running bugs to their holes. The greater number of life-wasting diseases are not bacterial in origin; and even the growth of the bacterial diseases depends on the soil in which they are sown."

On the following pages it will be found that in the fresh blood lies this pathology—these premonitory symptoms. The "symptom of the symptom" can be seen in the examination of fresh blood. It will be seen that the germs are, as Dr. Gould says, not the only cause of disease; for the fresh blood here is shown to contain this "soil"—of one at least of the most prevalent diseases with which mankind is afflicted.

These remarks are the foundation of this teaching and the theory is borne out by the results shown in this work. We also want to emphasize the fact that an examination of the blood is the surest way of diagnosing the disease when it is well seated. This logically follows not only from the previous remarks, but it is very evident that a disease cannot be chronic or advanced (as the term chronic signifies) without going through the various stages from inception to its most severe form when it is seen much more plainly in the blood. Therefore the blood reveals disease in not only its incipency but in its advanced condition.

With such a wide range of conditions and diseases discernible by the hematologist, when allied with experience as a general practitioner, none should be better able in these days



to make a diagnosis than he. This being true it is much easier to give a prognosis and say whether the case is amenable to treatment or not.

More than twenty years ago a prominent physician of this city took a microscopist to one of our large hospitals to examine the blood of some cases of syphilis, a disease the direct source of which has never been determined. The object was to see if a difference between those who had the disease and those who had not could actually be determined. The examinations were made with no comment. Time went on and on, until ten years had passed—then casually, at a chance meeting of the two men, the hospital doctor told the microscopist that his diagnosis at that time was correct.

Is it right to wait ten years before acknowledging the truth of a new discovery, especially to one who has spent years of hard-earned money and labor in a cause we all love to call humanitarian? This practice seems to be in all walks of life, but should it be so with ours?

I was also told by the physician referred to that the microscope was the cause of more mistakes than any other instrument of diagnosis. Such a statement is not worthy to be considered. Were it not for the fact that such hasty assertions are regretted in later years, I would not quote this, for at the time those who make them forget that a novice cannot use a microscope as a means of diagnosis. They forget that there are unskilled gynecologists and surgeons and physical diagnosticians. So there are unskilled microscopists and there are others who use the wrong method of examination.

Wagner, the greatest modern musician, was thirty years a composer before he was acknowledged as pre-eminent. And why was it? Because his music was different from others; he employed different methods to produce his effects. He studied philosophy, painting, as well as music and the sciences. He then wove his knowledge into each piece of his music, so that the theme of his operas when reproduced recalled to the educated ear the figure, the man or the scene which the master had intended.

And so this science of the blood is a different branch of medicine. It is a science that looks at medicine from a new point of view. It is intended that all means known to science should be brought as aids to diagnosis. But still there are those who have made it a specialty, like the gynecologist or the surgeon. There have been few Simses and Thomases in the past. So there are microscopists of different grades to-day. Some have the arts so mixed in them that they perceive with little trouble and by a simple examination some symptoms at which others have to spend hours, just as Paganini acquired his skill in playing the violin by a daily practice sometimes twelve hours long. So there are microscopists who labor for hours on one point. The others may be considered only dabblers at it. But the microscopists who examine the fresh blood specimens are those who make the fewest mistakes in diagnosis. This must be true, for they see the blood nearly in its natural condition. Have the patient present, doctor; examine no dried blood specimen.

Probably the first man to study the blood microscopically was John Hunter. It was certainly in his day that it was best known macroscopically; that is, as it flowed from a wound and was collected and studied with the naked eye. Physicians in those days could tell more or less about disease by the gross appearance of the blood when thus observed. This was more than a hundred years ago. Blood-letting has died out, and with it died the examination of the blood for disease. In the forties Virchow discovered the condition he called leukemia, a disease which is considered fatal, and which is characterized by the great abundance in the blood of the white cells—hence the name.

In 1846 Otto Funke, of Leipzig, published a book in which he showed fibrin filaments in the blood. The spirochaetae of Obermier, a filamentous parasite, was found in the blood of malarial patients somewhere about this time. Outside of this, little or nothing was known to be in the blood of a diseased person. It was not studied by the profession at large at all. About 1880, the idea came to the German physicians that

evidence of disease could or should be found in the blood. About this time germs were beginning to take a prominent place in pathology. In locating them, and in differentiating one variety from another, stains were being used. It was natural, therefore, that they should be used in blood study; and this, I suppose, is the reason why some physicians should investigate by means of stains, leaving the old method, which was the better and more natural laid down by Virchow, and using the unnatural method of killing the blood.

Ehrlich probably was the original pioneer in this work, and set rolling the ball which is still going to-day, for the staining of blood is done for purposes of examination in all hospitals and laboratories.

My work, however, lies along different lines. I use no stains, but examine the live blood fresh, as soon as it is drawn, in order to note the changes that take place. The fibrin in the fresh blood is a normal product, *and different states of it are pathological*. There are diseases in which there is little fibrin. Very often bleeders have so little that it is thought they have no fibrin in the blood.

But fibrin is one of the invariable constituents of normal blood. It is a fine, invisible net-work which circulates in the blood continually wherever it goes. On exposing the blood to the air, the fibrin oxidizes and contracts, which makes it visible under the microscope. It is well known that if one whips the blood, the fibrin can be easily obtained. This has been taught in our physiologies for years. This whipping merely separates the cells and forms the fibrin into coarse strings. This same fibrin in its natural condition is what I refer to. It is one of the prettiest sights that can be seen through the microscope, being a faint, fine crystalline appearing cobweb of normal fibrin filaments. It is quite a fad to count the number of cells and estimate the percentage of hemoglobin in the blood by delicate instruments. This in time will give place to more simple methods, and, in fact, such methods are already being used. As it is usually done now, it is merely secondary compared with other things. One who has had experience can

tell with the eye if there is much variation. This will be illustrated in the body of this work. Besides, what is the difference if the white cell show 15,000 to the cubic millimeter or 20,000, or whether the hemoglobinometer shows 80% or 85% of hemoglobin? Practically all will agree that it makes no difference, for the various physiological conditions which modify these proportions are too numerous to mention, to say nothing of inaccuracies attributable both to the observer and the instruments. Two observers never exactly agree.

A large number of microcytes (small red cells), my observations lead me to conclude, are found in people who may simply be called neurotics. They are very characteristic when abundant. What is called the poikilocyte of Ehrlich is simply a red cell out of shape and weak—it has lost its tone. These are very readily seen.

From a blood standpoint, all tuberculous people have rheumatism no less than the regular rheumatics, but the pain is more or less present. Rheumatism from this point of view is characterized by a thickened, adhesive condition of the red blood cells. Most people with paralysis, emboli and apoplexies are rheumatic.

I would like to call attention to a fact which all physicians know, but often forget; that is, that a sick person never has one disease alone—that the whole system suffers. This we were taught in our high-school education, and it still holds good. The disease physicians like to call by name is the one that produces the most pain or causes the deformity. These conditions show in the blood. Often we diagnose a certain disease from a blood standpoint, and it covers more ground than the old method of diagnosis. For example, we say from a blood standpoint that a man has rheumatism, yet the disease may never have shown itself externally in other organs—the blood is the largest organ and is fluid besides. Rheumatism affects the entire blood. We have rheumatism of the joints, of the muscles, of the eyelid, of the ear, in fact, of all parts of the body. The blood shows them all.

In fibrous tuberculosis, the tubercle bacillus is generally



not found. The value of an examination of the blood in this condition cannot be overestimated. Yet, I want to emphasize the fact that it will take long experience to diagnose this form of the disease. In tuberculosis there is always found a granular matter in the blood-serum and often in the white blood corpuscles. This I choose to call tuberculous matter, for it is found in all who have this disease, and there is at present no other appropriate name for it. It will be found in the tubercles that form; in fact, it is primarily their only constituent. It is the forerunner of tuberculosis—sometimes existing for years. In advanced tuberculosis it exists in the blood in abundance. As a patient recovers it will be seen to become less.

Often, as time goes on, after a discovery has become recognized, the real discoverers are ferreted out and posterity honors their names as former generations were incapable of doing. This book is not supposed to give a complete history of the pioneers of this work. Some examiners may have interpreted things one way and I another, but I take all the responsibility of this work as presented. There may be those who think that credit enough is not given to some, and there certainly will be opinions that swing the balance the other way. I have taken a little here and a little there; but, perhaps, the dross has been separated and a system prepared.\*

All I can say is: If the balance has been swung a little too much this way, or a little too much that way, time will adjust it. Be patient, for the old saying is still true: "Truth crushed to earth shall rise again."

---

\* What is meant here is that a new presentation of the subject has been prepared. It is not intended to convey the idea that here is an incontestable system. But the way has been laid for a greater work on the subject to follow by some one who may pursue it still further.



METHOD OF PROCEDURE  
FOR A  
FRESH BLOOD EXAMINATION.





## HOW TO GET THE BLOOD.\*

To get blood for a fresh blood examination it should be taken from the wrist so as to obtain the capillary blood. This is pricked with a clean lance. The drop is squeezed out and placed on a glass slide, over which is put the cover glass. It is then put under the microscope and examined at once. A 1-6 objective (400 diameters) is all that is required. We take these low powers in order to make the work practical, and within the reach of every physician, whether specialist or general practitioner, and trust each will see, before we finish, wherein lies its value to him.

There are in the blood then, microscopically, the red cells, the white cells, the serum, and the fibrin network. In normal blood there are said to be about three hundred red cells\*\* to one white cell. In studying, microscopically, diseases of the blood (and disease of the blood is disease of the body) we do so by noting:

1. The appearance of the blood as a whole.
2. The general color of the blood.
3. The way in which the specimen moves. Important in tuberculosis, rheumatism and tumors.
4. The number of red cells and their coloring matter.
5. The number of white cells and their contents. Easily told by their white color and granular appearance. Note their ameboid movement.
6. The arrangement of the cells. Their behavior to each other. How the red cells float separately and distinct.
7. The form of the fibrin.
8. The study of the individual cells.
9. The germs in the serum and in the cells.
10. Fermenting, pigment and foreign matter in the serum.
11. Granules and crystals of various kinds.

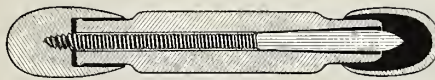
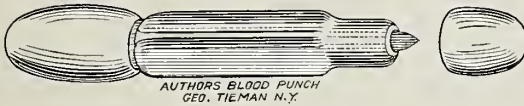
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\* See illustration on page 31.

\*\* Klein says there are from 600 to 1,300 red cells to one white in normal blood. This being true, it demonstrates still more plainly (as is pointed out in another section) how impractical it is to count these cells with any degree of accuracy.



## LANCES.



Two kinds of blood lances. The top one was bought by the author in London some years ago, and is a very practical instrument. The two lower ones are two views of his own instrument. It will be noted that the blade is flat instead of round.





POSITION BEFORE LANCING.



SQUEEZING BLOOD FROM THE SMALL PUNCTURE BEFORE PLACING ON THE SLIDE.





SHOWING POSITION OF LIGHT, MICROSCOPE, GLASS SLIDE AND EXAMINER.





# MOVING BLOOD CELLS.



## MOVING FRESH BLOOD CELLS.

Figures 1, 2 and 3 illustrate how fresh blood should be moving about when placed under a microscope. Figure 1 is fairly healthy blood, and it illustrates how, at a glance, one can see certain changes. It will be noted immediately here that the behavior of the red cells toward each other is normal. At the same time it can be seen that there is an increase in the number of white cells; at a glance at least six white corpuscles can be counted. It cannot be too deeply impressed upon the student that the blood must be moving when placed under the microscope, for there are products that disappear on exposure to the air, and there are other products that come into view. The fresher the drop the nearer it corresponds to that in the living being. There are products that can be studied at leisure, and they will be apparent.



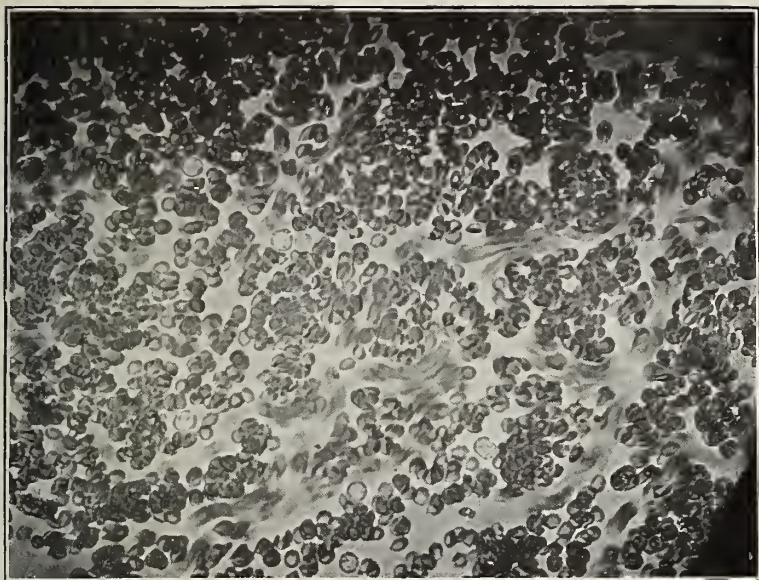
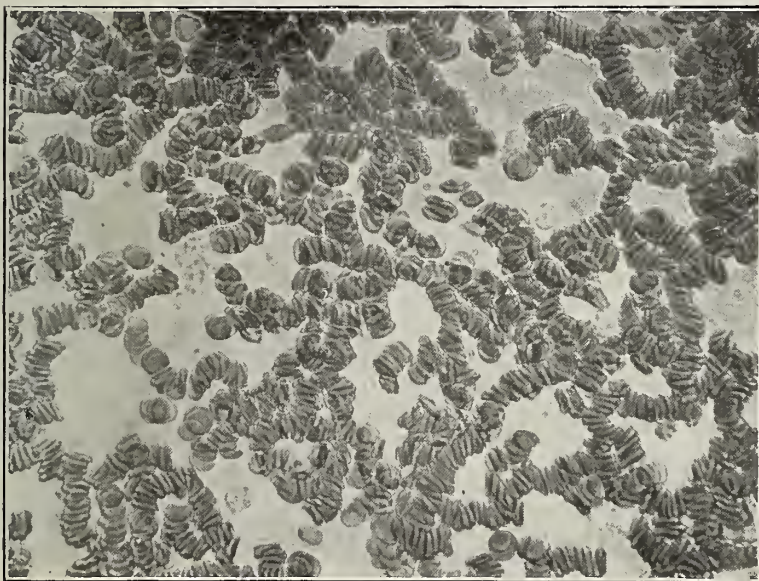


FIG. 1.—Healthy blood moving under the microscope.



Blood cells of Fig. 1 at rest.



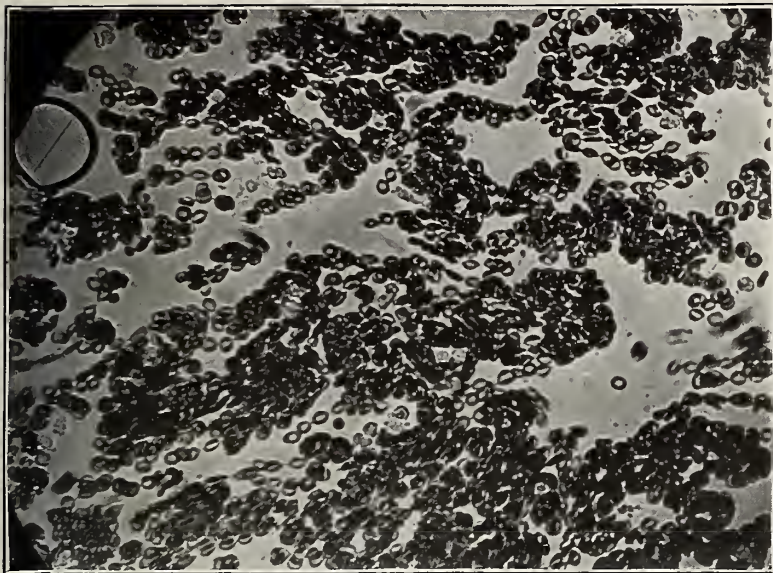


FIG. 2.—Freshly drawn blood in motion under the microscope.

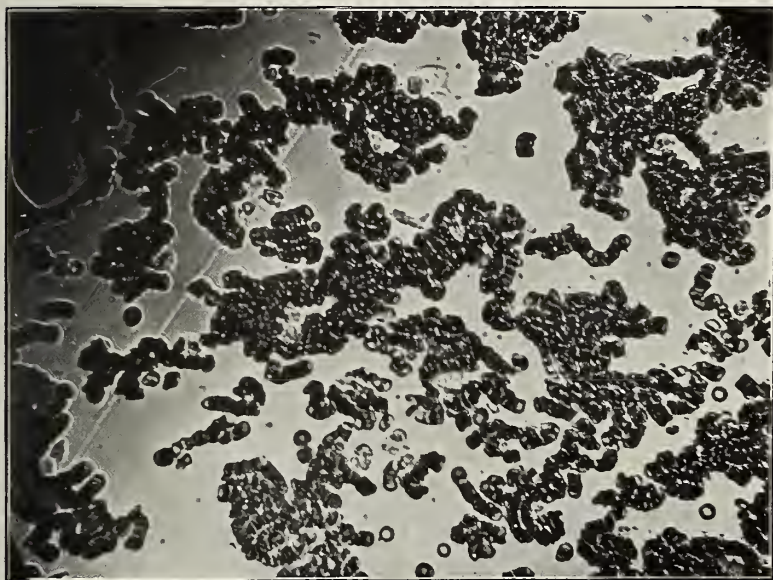
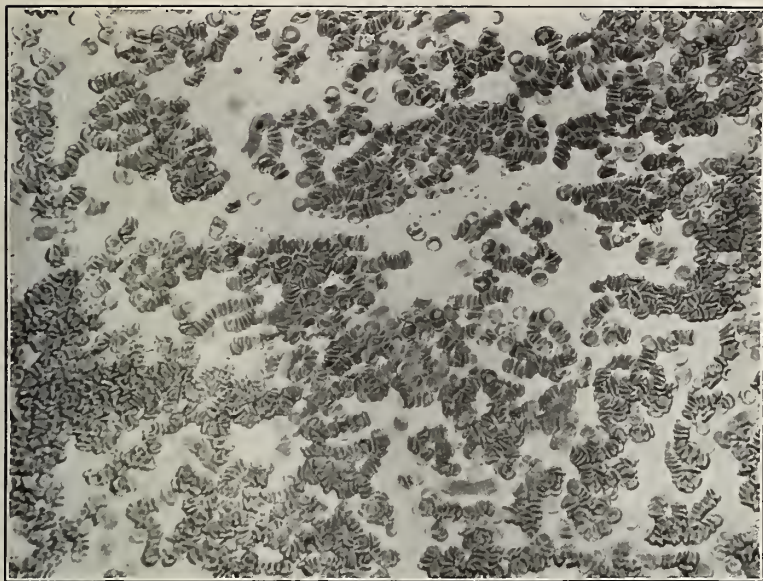


FIG. 3.—Same as Fig. 2 after standing two minutes. The line diagonally across the left is a defect in the glass.

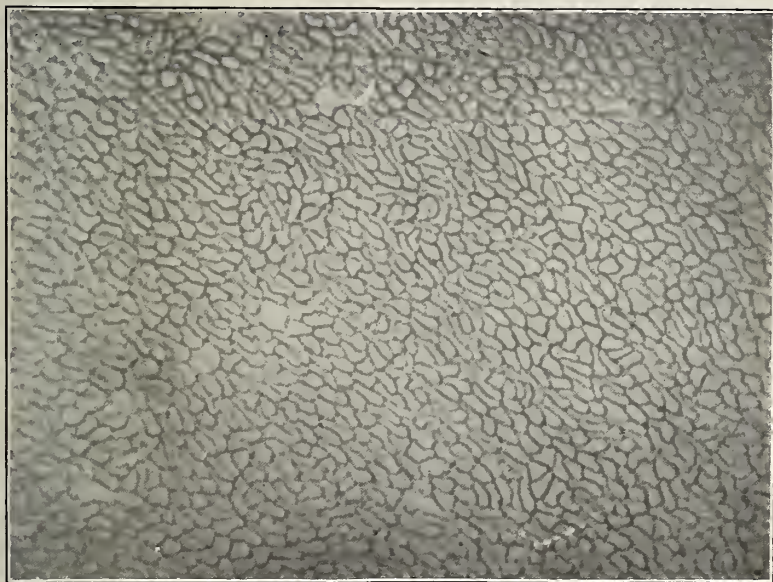






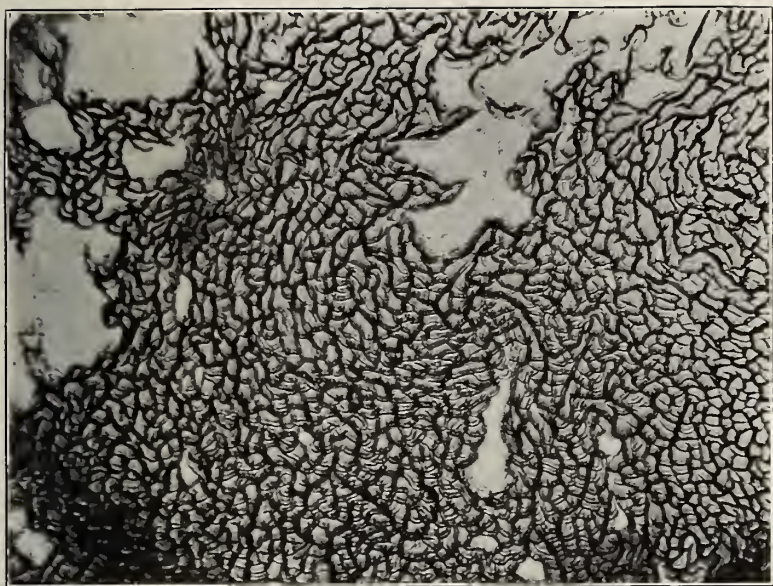


This and the three succeeding pictures show how blood dries by standing. Taken at intervals of one hour each.

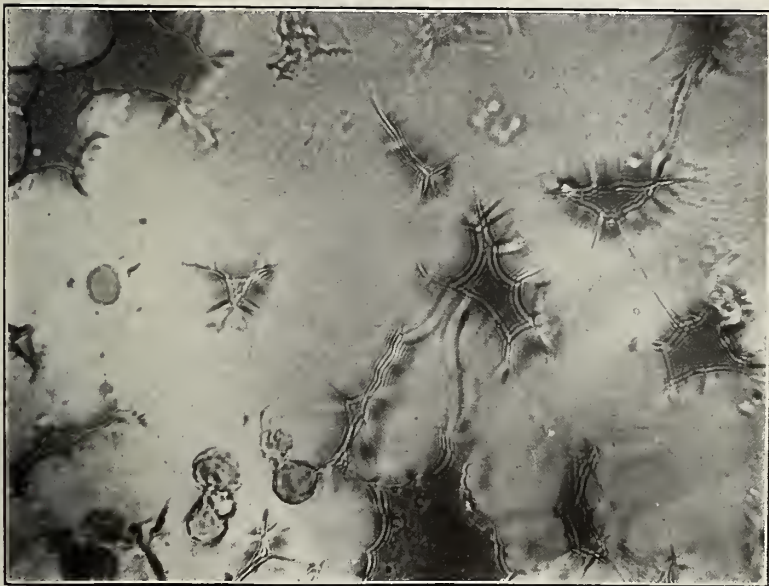


2.—Dry blood.





3.—Dry blood. Outlines of corpuscles have disappeared.



4.—Dry blood. Blood does not always dry in this shape or order, but the illustrations show how this specimen dried, and also emphasizes the fact that blood should be examined fresh.



The two cases given on the following pages are to illustrate the ideal method of fresh blood examination. It is not always possible and convenient to follow this method, still it is a good one for the beginner to practice on.





## ILLUSTRATIVE CASE I.

In making a clinical examination of the fresh blood of a person without asking any questions, the following is the way the mind of the examiner runs in the given case:

What do you know about this man from his blood only?  
Fig. 4.

This is the way one's mind would run in the examination: This man is in a bad shape; I cannot tell whether he ought to be in bed, or what he looks like in the face, any more than the ancients could judge of the character of Socrates by his looks, but I should think there is some disintegration taking place inside the man. The red cells are anemic; there may be some kidney weakness, while the great number of small red cells (microcytes) looks as if the nervous system was affected. There cannot be any rheumatism or consumption because of the arrangement of the cells and absence of fibrin and tuberculous matter. Blood poisoning might be suspected here, but no germs are seen.

When he is examined we see that he is stout and red-faced, and appears healthy. The eyes are  dull.

We will ask the man a few questions and see what he says.  
"What is your trouble, sir?"

He says that his speech is getting thick, and that he is gradually losing his power of locomotion. His wife informs me that this came on once before, a year ago; that his family physician, Dr. Granville C. Brown, made a diagnosis of Agraphic-Aphasia, a form of slow paralysis. There was then a partial loss of feeling in both hands. This man gradually and steadily got worse and died in one month.

## CASE II.

What can you say about this man's blood without seeing him, simply from an examination of the photograph? Fig. 5.

This is what is called both thick and thin blood.

The red cells adhere to each other in small agglomerations like a bunch of grapes. In this rests its thickness. But there

are not many red cells to the field. In this respect the blood is thin. This thinness also can be judged by its extreme fluidity when the drop is squeezed from the wrist. It will be noted that there is abundance of serum—the watery portion between the cells.

The white cells, also, are abundant, especially the ameboid variety. The glands are probably affected. From these facts you know this person has not articular rheumatism, and no hard fibroid tumors.

Physicians too often forget that a disease never exists alone. That there are always others that accompany it. This should especially be borne in mind in blood examinations.

It is the disease that is the most conspicuous, that causes the most pain, or that produces the deformity that people and doctors wish to call by name.

The arrangement of the cells in this photograph is often found in consumption; hence, if this photograph contained tuberculous matter, and the tuberculous fibrin, one would say immediately that this man has tuberculosis of the lungs.

He had an epithelioma of the face of long duration.



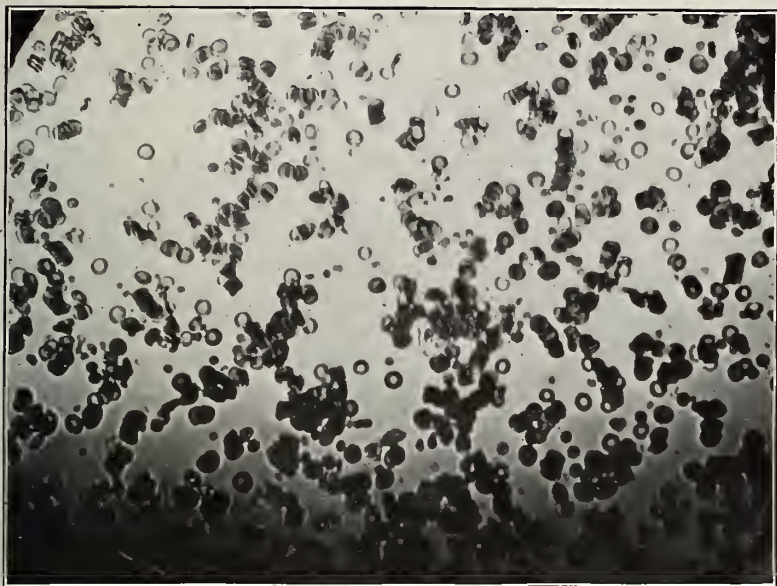


FIG. 4.

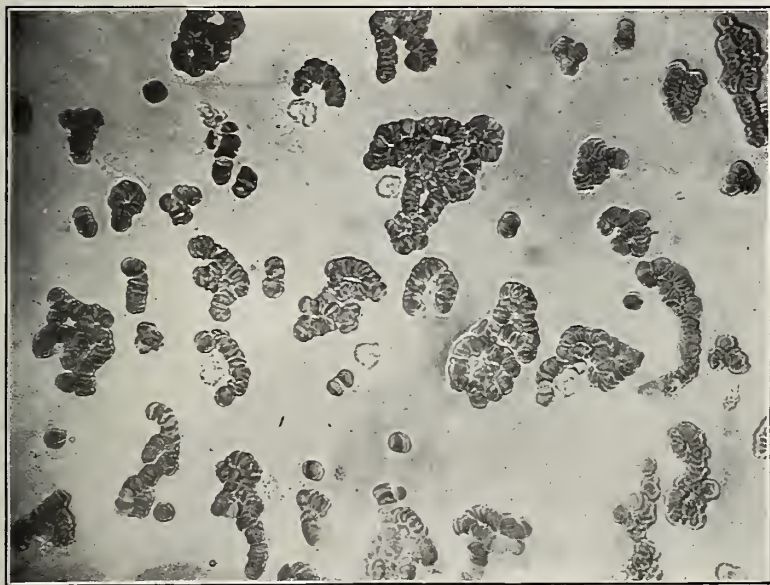


FIG. 5.



HEALTHY BLOOD.



Here are given several photographs of the healthy arrangement of the blood cells. It must be noted that this arrangement is especially called healthy in order to distinguish it from the abnormal adhesive condition. Figs. 6, 7, 8, 9, 10, 11.

For example, blood may be unhealthy and still have the healthy arrangement of the cells, as pointed out in the previous section; for instance, there may be germs of various kinds in the blood, and still the cells will be evenly distributed, but when one has rheumatism or tuberculosis, especially of the fibroid variety, the cells are then adhesive and strung out, as in the following pictures. This always occurs in those who suffer from any form of rheumatism, as pointed out in that section. When fresh blood diagnosis is classified and studied as it should be, it will be found that there are many diseases, especially of the chronic variety, such as epithelioma, fibroid tumor, etc., that show this adhesive or rheumatic condition in a very marked degree.



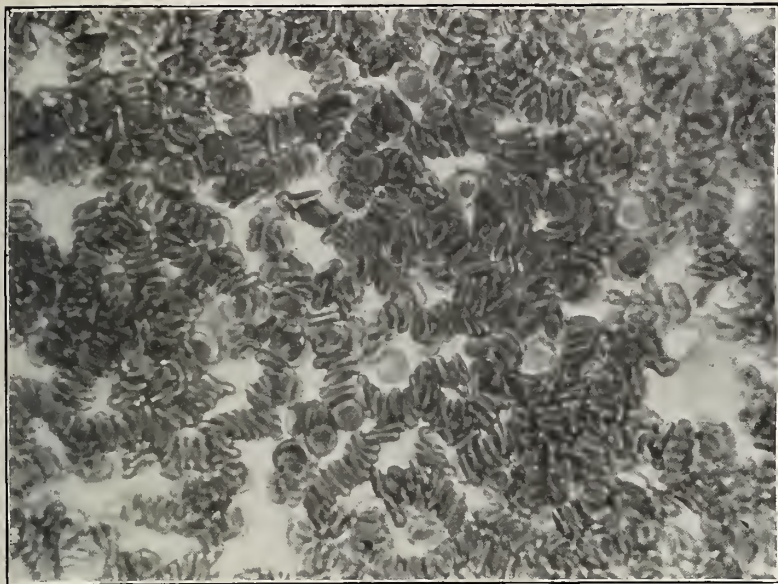


FIG. 6.—1-12 obj. Healthy blood.

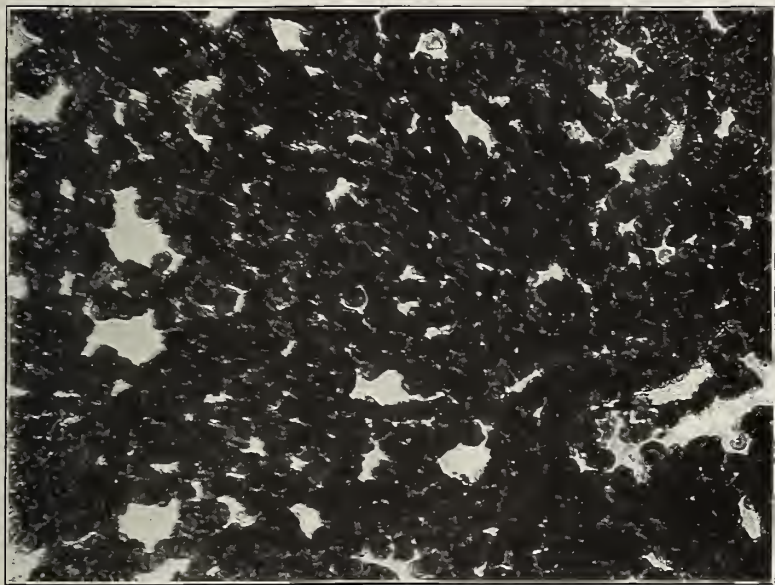


FIG. 7.—1-9 obj. Healthy blood.







FIG. 8.—1.8 obj. Healthy blood.



FIG. 9.—1.6 obj. Healthy blood.



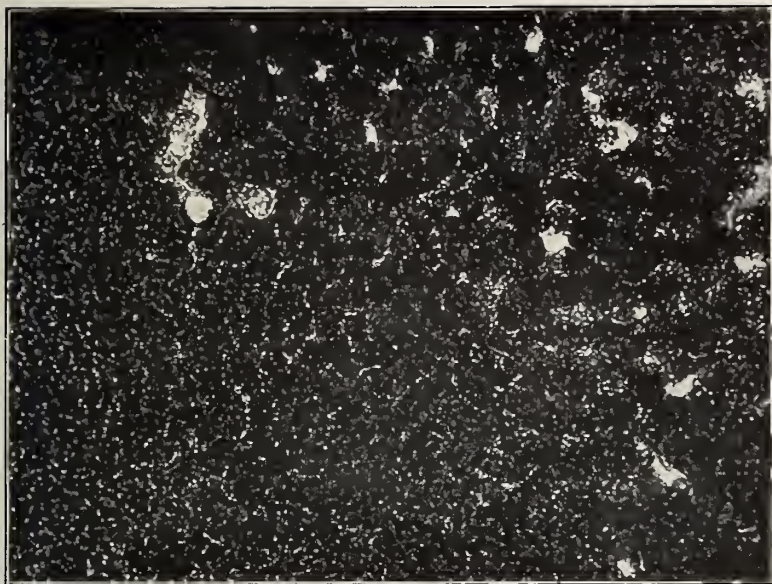


FIG. 10.—1.7 obj. Infant's blood.

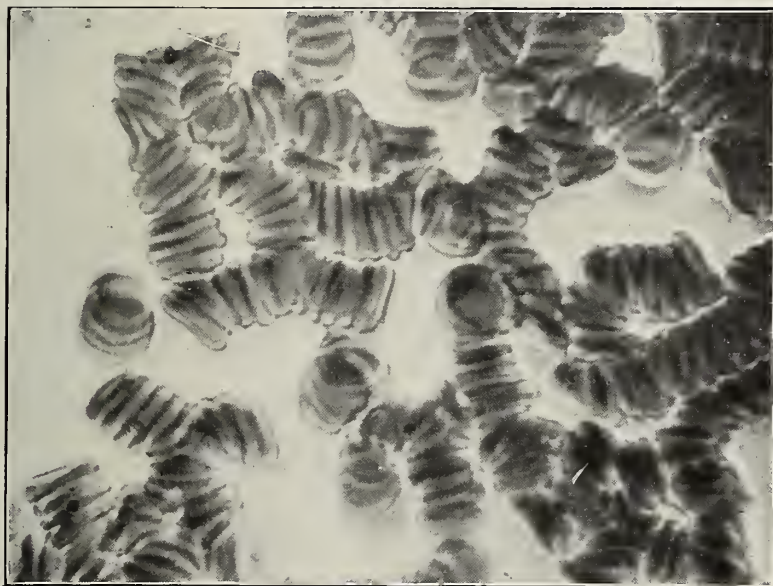


FIG. 11.—1.12 obj., 4 ocul. Infant's blood. Note the short rouleaux.



UNHEALTHY BLOOD.



The opposite or unhealthy arrangement is shown on the next few pages. It is so thoroughly characteristic that comment is unnecessary, more than to say that Fig. 12 was taken from a man very low with a fatal disease, and Fig. 13 from a child ten years old. Figs, 14, 15. Similar cases.





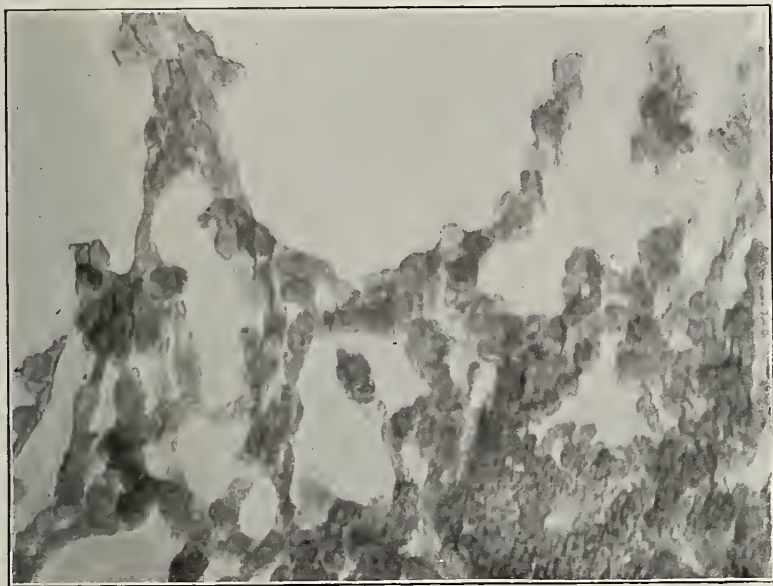


FIG. 12.—Unhealthy blood.

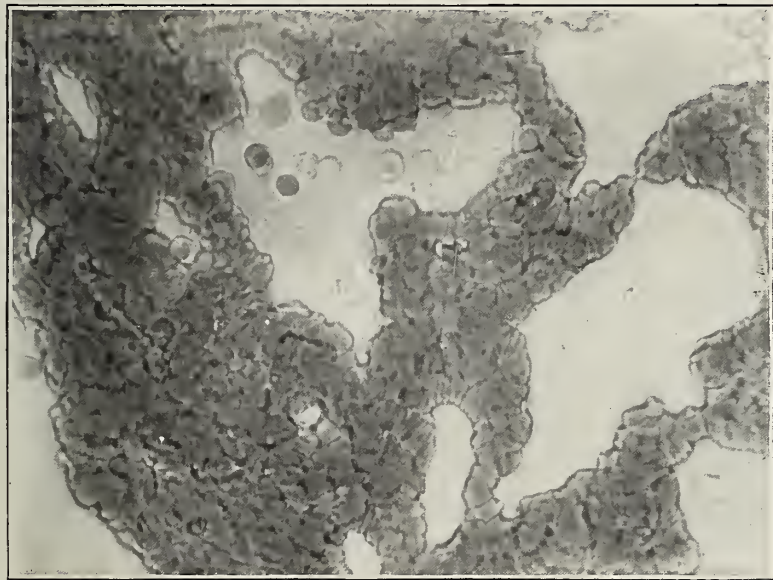


FIG. 13.—Unhealthy blood.



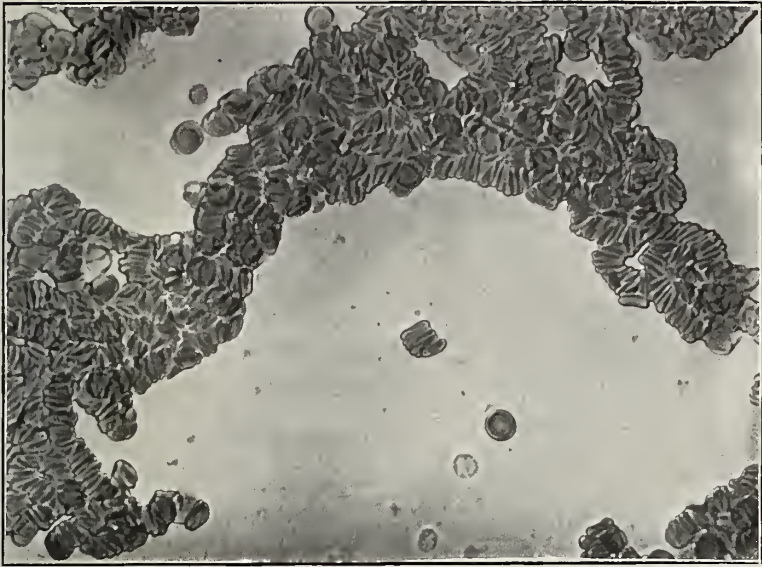


FIG. 14.—1-7 obj. Unhealthy blood.

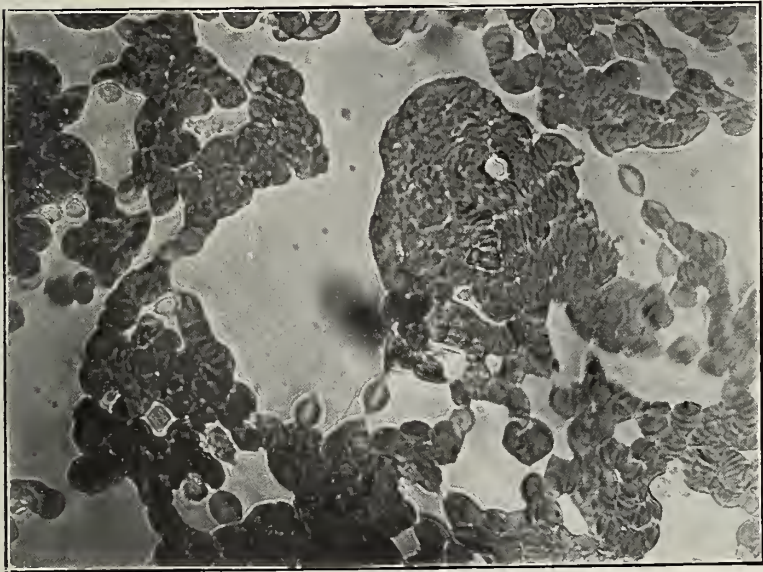


FIG. 15.—1-7 obj. Unhealthy blood.



# TUBERCULOSIS.



A demonstration that tuberculosis originates in the blood.





## TUBERCULOSIS.

### SYNOPSIS:

HISTORY OF A TUBERCULOSIS INFECTION IN THOSE AFFLICTED WITH PULMONARY TUBERCULOSIS. — NODULES OR TUBERCLES A PRIME NECESSITY FOR TUBERCULOSIS. — ANTECEDENCE OF NODULES OR THE GERM OF CONSUMPTION. — PROOF THAT THE NODULE IS PRIMARY AND THE BACILLUS ONLY AN ASSOCIATE.

So far back in history as medical literature can be traced, it has been known that tubercles existed in the human system. In 1803, long before the microscope came into general use, Bayle\* pointed out the tubercle as a pathological product. Step by step with use and growth of the microscope, knowledge of the morbid anatomy of the cheesy tubercle has gradually developed.

In 1820, without the use of the microscope, it was believed that tubercles had their distinguishable forms, "the transparent, the semi-transparent, and the opaque." In 1839, Magendie\* advanced the idea that "perhaps tuberculosis matter may be detected in the blood." He then states that he examined a fibrous sac in the heart of a woman who died of phthisis, and that he was able by means of the microscope to determine that it was filled with *tuberculous matter* and not with pus. Microscopes in those days were crude, and he does not say how he differentiated, but he continues: "The Hotel Dieu furnishes similar ones (cases) which give new strength to my persuasion that we shall find in the blood the cause of a host of diseases, and in every instance a fresh source of instruction."

"The primitive tubercle is a microscopic body,"\* so considered because of its minute beginning, and it steadily grows. \* \* \* \* "It may be called cellular or fibrous tubercle \* \* \* \* according as the cellular or fibrous element of the tubercle predominates \* \* \* \* the former being the more common." This distinction shows the early recognition of the varieties of tuberculosis. The article goes on to say that it is difficult to distinguish the fibrous from a small

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\* See Bibliography.

fibrous tumor. "W. Addison, in 1849, taught that it (tubercle) consists in greater part of corpuscles, like blood leucocytes or like the corpuscles of lymph and pus." "Addison believed that the lymphoid corpuscles of tubercle were the result of exudation from the blood through the walls of the vessels." "He pointed out (in 1856) the frequency with which tubercle is seated in the outer coat of the small bloodvessels in cerebral meningitis." This "scrofula matter (Bayle's granules) prior to 1803 was looked upon as wholly a deposition from the blood and later (1853 and thereabouts) the tuberculous dyscrasia was an accepted term, used to signify that the process originated in the blood. This term has been used by many in recent years.

It was argued that sometimes the tuberculous process started simultaneously in two or more localities far apart, and physicians expressed it thus: "It is not asking too much to suppose that the common cause exists in the common bond of all organs and tissues, i. e., to say the blood."

Watson,\* in 1845, said: "Tubercles themselves are composed of unorganized matter *deposited from the blood* of a yellow color and about the consistence of cheese." Addison, in 1849, taught and others considered tubercle to be composed of pus and lymph corpuscles. In 1865, "Woldenburg, Sanderson, Chauveau, and most other pathologists, deem it (the virus-dyscrasia in the blood) to take the form of minute solid particles."

Villemin\* (1865) began to experiment by inoculating animals with tubercle in order to produce the disease. These experiments seemed to be successful, and thus a new train of thought was started. But from the above evidence "Boyle's granules of scrofula," Magendie's proof of its being in the blood, the fact it started in two places at once, the tubercle dyscrasia, Watson declaring that "unorganized matter" in tubercle "was deposited from the blood," Addison's tracing the deposit from the blood into the small vessels of the brain—and his pathology as far as it went agrees with that of to-

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\* See Bibliography.

day—Woldenburg's and others' belief—show that previous to Villemin's experiments it was generally accepted theoretically, at least, that tubercle was caused by *direct deposit from the blood*.

At this time bloodletting was being considered an old-fashioned practice. This fact, together with the attention of the profession to the experiments of Villemin and others, it would seem, set back *the blood-origin of tubercle in a most positive way*.

Friedlander\*, in 1872, began to find "lumps of tubercles in joints;" before this the matter was thought to be confined to the lungs. Although the miliary tubercle has been known for years, new meaning seemed now to be attached to tubercle. The tubercle became a medical fad and tubercles were found more frequently than ever. Then came the announcement in 1883 by Koch that he had discovered the cause of tuberculosis—the tubercle bacillus. As a result, the theory of the blood-origin of the disease was buried deeper than ever. But another result of the discovery of the tubercle bacillus was that tuberculosis became more widely recognized than ever, and to-day it is taught in all our institutions that this bacillus is the cause of tuberculosis in all its forms.

*If this bacillus is the cause of tuberculosis*, as is generally claimed, then the germ must be in the tubercle or, at least, about it, even in the tubercle's microscopic form. Consequently, *the germ must be present first. Is it present first? Has this ever been demonstrated?* It is claimed that these bacilli are carried to the tissues *by the blood*, and still it is acknowledged that they have never been found in the blood. It is generally claimed by pathologists that this germ is the cause of all tuberculous lesions. In the books of several authorities I have failed to find this disease defined as being *caused* by the tubercle bacillus. Yet these authors implied that such was the case. It seems they have a less positive word than *cause*. Osler\* (1896) says "tuberculosis is an infectious disease *due* to the introduction into the system of the bacillus tubercu-

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\* See Bibliography.

losis, and characterized by the presence of nodular bodies called tubercles." Gould defines it "an infectious disease *due* to the introduction into the system of the tubercle bacillus." Neither of them quite care to say *caused* by the tubercle bacillus. Judging from the wording it would strike one that these men were themselves hardly ready to claim that tuberculosis was caused by this germ, though admitting that somehow the germ must be present. In books where this disease is defined as being caused by the tubercle bacillus, before the authors are through with the subject they beg the question by saying that this bacillus is not found in all tubercles. Therefore, the most consistent definition according to the accepted facts are such as Gould's.

But to come to the point, what are these tubercles, these miliary bodies which we have traced back 100 years as the known cause of this disease? The history of these tubercles was even known in the time of Hippocrates, and they are today found in all cases of tuberculosis. What is the composition of these nodules,\* these tubercles, which Osler declares in his definition are as necessary as the tubercle bacillus?

Authors differ only slightly in their analyses. Delafield\* says that they are composed of "granular matter, pus-cells and epithelium." If the origin of these constituents can be explained, then we have explained the origin of tuberculosis; we have, at least, come nearer the truth than those who accept the theory of the tubercle bacillus. The pus-cells, then, are the exudated leucocytes—the epithelium is from the hyperplastic cell-wall in which the deposit is made. This is due to physiological functioning which we all understand and common sense demands its acknowledgment. It is perfectly evident that the only constituent left of a tubercle to be explained is the *granular matter*. To review: There are three constituents of a tubercle, (1st) granular matter, (2d) pus-cells, (3d) epithelium. The pus-cells are transuded white blood cells from the blood vessels. The epithelium is the extra deposit from the wall of the air cell with which it is lined

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\* See Bibliography.



due to the extra work. The granular matter is still to be explained.

We have now to show what this granular matter is, or from whence it comes to complete the demonstration.

In 1895, when I was in Paris, the fact that surgeons had successfully operated on tuberculous peritonitis, by simply exposing the inflamed peritoneum to the air, and closing up the wound, was exciting some interest. Malassez, it was reported, had had several successful cases. Dr. Murphy, of Chicago, whom I met at the time, told me he also had operated with the same results. The simple and unaccountable result astonished these operators. The astonishing recovery of patients from this simple operation is now well known. What was the cause of the recoveries no one knew, but it was a fact that the tubercle disappeared and the patient recovered. Was this result due to the exposure of the tubercle bacillus to the air, or was it some other consequence of the operation?\*

It occurred to me there was a product in the peritoneum in these cases similar to one that I had observed for several years in the blood of tuberculous people. When a drop of blood freshly drawn from a patient suffering from tuberculosis is placed under the microscope, granules are seen in abundance. These disappear in a few seconds, probably because of exposure to the air, although this is not positively known. Must it not be either that these products in the tubercles of the peritoneum and these granules in the blood are the same or that one is the factor of the other? Perhaps the climatic treatment of tuberculosis may be explained on this basis more logically than on that of the germicide theory.

The tubercle bacillus, it is claimed by authorities, is found in all individuals who have tuberculosis. This being granted for the sake of argument, it must be evident that this germ must have something on which to live, something to attract it. In the laboratories it is cultivated on artificial media. In the body it must have a more natural soil. There must be some-

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\* See Bibliography.

thing in the bodies of tuberculous people that is constant. What is it? That question was asked more than 50 years ago. To-day it can be answered.

In 1893, in the Loomis Laboratory, I took two tubes of blood and planted on each a pure culture of the tubercle bacillus. These tubes were sterilized and taken under antiseptic precautions. In one tube was drawn the blood from the vein of a man with advanced tuberculosis, in whom the granules were present. In the other was drawn the blood from a non-tuberculous patient, in whom the granules were not to be found. These specimens were taken from patients in St. Catherine's Hospital, Brooklyn. On the tube taken from the tuberculous man, the germs developed, while on the non-tuberculous no growth was obtained even after six weeks' time in the incubator. This seems to prove that there is a nidus in the blood of the tuberculous that is absent in those who have not this disease. For the benefit of those who think that bouillon is the only medium on which this germ will thrive (for that is the common medium in the laboratories), I will state that at the same time these other tubes were in the incubator, I placed the same germs in a tube containing cider-vinegar as a medium in which were pledgets of cotton. On this the tubercle bacillus thrived most wonderfully in a short time.

Delafield\* says again: "For the development of tuberculous inflammation in any part of the body there is necessary the proper disposition of the individual," and he, with others, said "that the bacilli are transported by the blood." Are these men not mistaken as to what is transported by the blood? For they acknowledge that the bacilli cannot be found in the blood.\*\* Is it not this demonstrated medium that is transported by the blood? Is it not these granules that constitute the disposition of the individual? These can be seen in the living blood, and it is no far stretch to thus identify them.

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\* See Bibliography.

\*\* See illustration on page 131.

From these facts it seems to be proved that the tubercle-bacillus is a secondary factor; in fact, a direct result of the tuberculous process, instead of its primary cause. Before life can exist there must be a medium on which it can thrive or develop. The body must be nourished or it will die. Herbert Spencer says: "Amidst all the mysteries with which we are surrounded, nothing is more certain than that we are ever in the presence of an infinite, and eternal energy, from which all things proceed." So in its more minute forms, food is the only source from which life forms can derive energy. The germ cannot exist without food, but the food can and does exist without the germ.\* In other words, these germs are the result and not the cause of the pathological process.

In order to live the germ must necessarily make its home where food exists. Man would not think of dwelling in a place where his nourishment could not be had. That which disease feeds on, then, is primary to the existence of disease, and the germ itself secondary. I have heard that it is claimed by some authorities that the bacillus of Koch does not make its appearance until the tubercles break down. For example, they are not found in the sputum until after the lungs or the involved tissue undergoes ulceration. This, in itself, is proof that the presence of the germ is secondary in the tuberculous process and not its cause.

To sum up, we have shown that:

1. For nearly a hundred years the cause of tuberculosis has been thought to lie in the blood. (It is said in mathematics that theory runs a step ahead of practice.)
2. The prime factor in the production of tubercles is matter deposited from the blood.
3. This deposit from the blood is a granular matter which disappears on exposure to the air.
4. This granular matter exists in all tuberculous people.
5. The germ of Koch will grow in blood containing these granules.

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\* A horse lives on grass. Grass can live without the horse, and the grass attracts the horse when hungry. Still the horse is not always present where grass is growing. To come nearer to the subject, we have germs on a stagnant cess-pool, but the cess-pool comes first and the germs afterward. The germs do not cause the cess-pools to exist. Neither does the tubercle bacillus cause tuberculosis to exist.

6. It must be these granules, deposited from the blood into the air cells, that produce in the lungs tubercles, which "are primarily microscopic bodies" in size, and gradually enlarge from fresh deposits into "transparent, semi-transparent, and, finally, opaque granules," or tubercles, which, in time—"three weeks to several years"—break down and form a medium for the tubercle bacillus.

A prominent professor once said that when a number of physicians had as many remedies for a single disease (malaria) it was pretty good evidence that they did not know the true one. But when all agreed on a remedy, then that was a specific and they knew what to do. (Malaria.)

So these granules in the blood have kept physicians in confusion for years. Some physicians have called them small corpuscles—yet they do not resemble corpuscles; others say broken down red cells of the blood. Bizzozero called them blood platelets or plaques. No two observers seem to agree, either on their description or composition. But these granules in the blood are the haematoblasts of Hayem, the yeast of Salisbury, the granules of Bayle (1803). It is their compression or coalescing that gives them their varied forms, and largely accounts for these different opinions. They have been called the granules of Ranvier and the globulins of Donne. They are found in the blood of all tuberculous subjects before the tubercle has made its appearance, and long before it has formed.

This granular matter is the "tuberculous matter deposited from the blood" of Watson. It cannot be anything else, for it is the only foreign matter seen in the blood with a microscope and the untrained eye. It is these granules which, on analysis, are found to compose a tubercle. This granular matter in the blood is in reality the blood dyscrasia spoken of by physicians for 50 and 100 years. It would have been seen long ago if blood-letting had not died out of fashion, for there was only a step to reach it. It exists in the blood months, and sometimes years, before the tubercle bacillus enters the system. This is plainly demonstrated from the fact that tubercles are composed of the only granular matter that the blood contains. It is this that constitutes the (old) dyscrasia of consumption. It is in reality the "tuberculous matter" of tuberculosis.



# TUBERCULOUS FIBRIN.



## TUBERCULOUS FIBRIN.

### SYNOPSIS :

#### FIBRIN A NECESSITY TO THE ESTABLISHMENT OF TUBERCULOSIS.

Besides the tuberculous matter in the blood of tuberculous people, there is fibrin in a characteristic state. This fibrin is thicker and appears to be more abundant than in normal blood. The picture is so pronounced and characteristic of the disease that any attempt at description would be superfluous.

As the tuberculous matter disappears on exposure to the air, the fibrin which is not at first visible gradually comes into view. There is a peculiar clumping or agglomeration of the red corpuscles in tuberculosis which is best seen in the pictures with or without the fibrin.

### SYNOPSIS :

#### VIRCHOW'S\* FIBROUS NODULE OR TUBERCLE THE BEGINNING OF OLD-FASHIONED CONSUMPTION.—ITS CHARACTERISTICS.

In fibroid tuberculosis of the lungs, or in fibroid disease, the red corpuscles are again arranged or agglutinated in a characteristic way peculiar to the fibroid condition (see illustrations).

Virchow\*\* and others have described a cellular and a fibrous tubercle. The former is the tuberculous, he says, "according as the cellular or the fibrous element of the tubercle predominates. It may be called cellular or fibrous tubercle." The latter, he says, cannot sometimes be distinguished from a fibroma. The cellular form is composed mostly of tuberculous matter, while the fibroid form is found when the fibroid condition of the blood predominates in the system. Thus, the tumor-like tubercle is formed with the tubercular granules present to a slight degree, and they serve as a nucleus.

This is the beginning of what in the old days was called "fibroid consumption of the lungs." The tubercle bacillus is not found in this disease until the tuberculous matter is pres-

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\* Koch's recent paper on tuberculosis led to the following remark : " Nothing remains for me but to maintain more positively than ever my view that the decisive thing in tuberculosis is the tuberculous nodule "Tuberkelknöthen," which is the pathological mark of tuberculosis, and not the bacillus as such."—Prof. Virchow at the London Tuberculosis Congress, July 25, 1901.

\*\* See Bibliography.

ent in the blood in abundance. It does not\* “die,” as one author said, but it was never present; it appears only in the combined tubercular and fibrous diseases (mixed varieties), which not uncommonly happens.

Fibrous consumption, or fibrous disease generally, then, is recognized in the blood by the peculiar piling up of the red cells together with the characteristic adhesiveness. This adhesiveness is distinguished easily from the rouleaux arrangement of health. In this latter it is a cohesion of the cells—no sticky matter between the cells.

I remember recently to have been called in consultation to an advanced case in which the tubercle bacillus could not be found, either in the sputum or excretions even on several examinations. The blood, however, revealed the fibroid tuberculous arrangement at once, and thus confirmed the diagnosis which the attending physician had already made.

The long experience necessary to get the proper confidence in oneself to diagnose this form of disease, accounts largely for the slowness of the profession in taking up this method of diagnosis.

I do not desire you to take my experiment (p. 80) as proof; consider it nil if you will. But the profession to-day, even the bacteriologists, have never proved their claim in tuberculosis. This is shown not only here, but in all the best works that I have consulted on the subject.

Allbutt's "System of Medicine" says (p. 15): "The tubercle bacillus is found in tuberculous lesions both in man and animals. In a particular lesion the bacillus may be absent, having died. (How does he know it died?) But in one or other lesion of the body of a tuberculous animal and in nearly all recent lesions (why not in all?) tubercle bacilli are readily found." This is a contradiction of his own definition, for he is one who defines this disease as "caused by the tubercle bacillus." I do not claim that the natural nidus of all specific germs is known or ever will be, nor would I discourage the investigation of germs. But I do insist that in this special dis-

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\*See Bibliography.

ease, the germs when present in the tuberculous process are attracted thereby to the primary tuberculous process heretofore described as existing in the blood; hence, they are a result, an associate of tuberculosis; and this falls in line with the natural progress of things. Many in the profession are becoming dissatisfied with the former belief as to the cause of tuberculosis and are looking for something beyond. If this cannot be read in plain type in authentic text-books, then it can be read between the lines.

I believe that the germ theory of tuberculosis as taught to-day is really believed by the minority of the profession.

During my hospital service, a certain consulting physician was accustomed to say: "Ride no hobby. Keep out of ruts." I would modify this a trifle, and say: "Keep out of ruts and ride no hobby to death." Most great men have had hobbies, but the greatest knew when to stop.

Those who acknowledge the tubercle bacillus as the cause of tuberculosis claim to have proved in their own way that the tubercle bacillus is always found in the tubercle, and that it is its producer. They say these bacilli have never yet been found in the blood, yet they assert there is something in the blood which not only produces but predisposes to the disease.

On the other hand, I have shown that there is a "seeable" ingredient in the blood in all cases of tuberculosis. This matter is acknowledged by pathologists to be a primary ingredient of the tubercle, being seen long before the tubercle bacillus can be found.



## FURTHER DISCUSSION.

### SYNOPSIS :

IS THE EXPERIMENT OF INOCULATING ANIMALS A NECESSITY?—  
IS IT THE METHOD OF STUDYING DISEASE WHEN OTHER MEANS  
ARE AT HAND?—THE RESULT OF THIS WORK IS CONFIRMED BY  
AUTHORITIES. — TUBERCULOUS MATTER CAN BE SEEN BY ANY  
PHYSICIAN—CALL IT WHAT HE WILL.

It would seem to some that we ought to consider in our discussion the claim that “the inoculation of *susceptible animals*, with the tubercle bacilli, produces the disease.” Therefore, we will give space for a little of this. For this, it is claimed, it seems by bacteriologists, is an *iron-clad rule* establishing a germ to be the true cause of a disease. It will be noted that the adjective *susceptible* always modifies the noun animal whenever an inoculating experiment is successful. It reminds us of the phrase used so often in surgical parlance: “The operation was successful, but the patient died.” It is self-evident that all animals which are injected with these bacilli do not develop or contract the disease. The question would naturally arise, what constitutes this susceptibility? I do not care to go into this discussion further than to say that the susceptible animals I have observed contain this tuberculous matter in their blood.

Sternberg's Bacteriology, p. 393, says: “They (tubercle bacilli) are more numerous in tuberculous growths of *recent origin*, and often cannot be demonstrated in caseous material from the center of *old nodules*.” Here it would seem is a statement proving that the germ is not the cause, for the author says it is not found in all tubercles. But to go on: “Such material when inoculated into *susceptible animals* gives rise to tuberculosis, and the usual inference is that it “contains spores of the tubercle bacillus.” They thus imply that it contains the infecting agent.

It has been, and is still, claimed that the old experiments of inoculating animals with other things than the tubercle bacilli have produced the same tubercles. One can poison any animal by injecting large quantities of these bacilli into



its system, and then, even long afterward, it will be found that the germs have actually increased in the system; but this is not the natural soil for these germs. For in its natural soil, at its proper time, the germ will come, and *that time* nature will decide. When, at that time, the soil and the germ will be associated, tuberculosis will be found. A number of animals with a certain limited amount of inferior food can be isolated on an island—the animals will develop and redevelop (the same as the germ), yet these animals—inferior animals at that—live a long time even on the inferior food.

Conditions such as the above, it will be seen, are unnatural. But suppose it is true, as it is claimed to-day by bacteriologists, that all susceptible animals inoculated with the tubercle bacilli develop tuberculosis. Let this sentence stand while we examine the facts.

Is any man who believes in the contagious nature of this disease going to allow another to inject these germs into his system? Does such process naturally occur in nature? You will answer "Certainly not!" Then why bother about the results of such unnatural methods? The true way to study disease is to examine it when not artificially produced.

The four rules laid down by Koch\* (1882), in order to prove that a germ is the cause of a disease, briefly are:

1. The finding of the germ in the diseased body.
2. Its cultivation on an outside medium.
3. The reintroduction into the body of this recultivated germ with the production of the characteristic lesions.
4. Noting that a greater number of germs are produced in the animal than were introduced.

With the exception of the first, these rules are all artificial. They are being dropped to-day, for they are found to be merely theoretical.

For example—the plasmodium of Laveran, which is the recognized germ of malaria, has never been cultivated outside of the body, and its reintroduction when found outside is not

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\* See Bibliography.



acknowledged to produce the disease according to Koch's rules.

These three rules are illogical, unnatural and mechanical. I mean by mechanical that in order to get these results instruments are used, such as belong to the artisan. Such methods are not made use of in nature.

The fact that Cohnheim\* some years ago claimed to have produced tuberculosis by inoculating non-tuberculous matter into animals, and now makes the statement that he cannot now get these results, and falls in line with the accepted bacteriological theory—this fact, I say, is sufficient to prove that the method is unscientific and untrue. Therefore, these results must fall into disuse.

The fact that the profession recognized the malarial parasite without its being artificially cultivated clearly shows that they at present recognize the true method of investigating disease. The constant presence of the plasmodium in malaria establishes, as near as any one can, its etiology. I do not belong to the anti-vivisection society; and I have experimented on many animals, but in the investigations connected with this subject it has not been necessary to kill or inoculate any animal to find the truth. This work can be and has been done by long patient observation and investigation extending over years. It is done on the living human being, without causing injury, pain or inconvenience of any kind, or even leaving a scar.

But more than that, the work represented in this book is confirmed by unsought autopsies, as well as demonstrated by the recorded result of post-mortem examinations reported in both ancient and recent authentic text-books of Pathology and the Practice of Medicine.

In regard to the contagiousness of tuberculosis, we will say with Watson\* that its "very dependence upon a peculiar diathesis would seem to disprove the supposition." He says:\* "Is phthisis contagious? No. A diathesis is not communicable from person to person. Neither can the disease be easily

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\*See Bibliography.

(if at all) generated in a sound constitution. Nor is it ever imparted in my opinion even by one scrofulous individual to another. Yet in Italy (1845) a consumptive patient could not be more dreaded and shunned if he had the plague. A girl dying of phthisis is nursed by her sister, who afterwards droops and dies of the same complaint. But the parties may be different in blood. (He means not related.) A wife watches the deathbed of her consumptive husband, and presently sinks herself under consumption; and there may be no traceable or acknowledged example of scrofula in her pedigree. Yet even here the latent diathesis may fairly be presumed to have existed. Very few families are perfectly pure from the strumous intermixture. The predisposition may be slight; it may be dormant for a generation; or like other inherited peculiarities it may light capriciously on some individuals only of the kindred. In both the supposed cases there have been other influences at work more authentic than the alleged contagious property (nowadays considered the tubercle bacillus) in calling forth the fatal malady. Watching, the want of rest, confinement in the unwholesome air of a sick chamber and, above all, protracted mental anxiety, than which no single cause, perhaps, has more power to foster and forward the inbred tendency to phthisis. The disorder, I am satisfied, does not spread by contagion.

“Nevertheless, if consulted on the subject, I should for obvious reasons dissuade the occupying of the same bed, or even of the same sleeping apartment, by two persons, one of whom was known to labor under pulmonary consumption.”

It will be seen that in this short quotation of opinions accepted fifty-five years ago, are embodied many of the ideas that are favored to-day; i. e., that the disease is contagious or infectious because there is a germ connected with the disease and which has been considered its cause. It will, however, be found that the predisposition must exist before the germ, and the germ only is the cause of a contagion (so authorities contend).

It is said that when two clocks with different beats are

placed side by side, after a time the tick of one approaches the tick of the other.

It is well known that when an exceedingly nervous person is constantly brought into the presence of a moderately nervous person the latter will after a little become as badly afflicted as the former.

With this tuberculous matter in the blood, then—to the same degree and in the same style is tuberculosis contagious. But if tuberculosis is contagious without this predisposition, then health is much more so. It will thus be seen that, considered at its worst, it is a matter of virulence or degree.

It is claimed by many that tuberculosis originates in the alimentary canal. If not wholly true, this is partially so; for disorder of the secretions of the stomach or intestines\* is often associated with this complaint.

The great Paganini,\* the violinist, who held the musical world for years with his warbling string, suffered from tuberculosis of the bowels, and died of it in 1840. It is said that when exacerbations of illness came on he suffered intense pain. And he had them every time he overindulged at the table. He was so easily tempted that in later years he seldom attended banquets. In most patients the disease does not show such marked and painful symptoms as it did in this great musician, who finally died of tuberculosis of the lungs. But in almost all cases this tuberculous matter can be traced in the lymphatic glands, the stomach, or the lacteals, which help metabolize the food before it is taken into the system.

Here, again, is a partial explanation as to why patients afflicted with tuberculous peritonitis recover when the surgeon exposed the thinly-lined tubercles in the peritoneum to the oxygen of the air and light of day. These agents suddenly change their chemical composition, and they are absorbed or discharged in or from the body by this new chemical process. It often takes years for them to re-form or re-deposit. I claim that these deposits are due to disorder of the secretions of the stomach or bowels, or both, and that accidental cures—as the

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\*See Bibliography.

surgical operation referred to above—and climatic changes are also due to accidental changes in diet, as well as to change in hygienic conditions. I have often observed that when infants are given quantities of sweets this tuberculous matter in the blood is increased, while the discontinuance of such ingesta is followed by a reduction of tuberculous matter in the blood. It is claimed by some that tuberculosis of the lungs is due to vegetable feeding. This seems to me to be overdrawn, but that it is due, partially at least, to fermentation\* must be true. I have never seen this statement discussed; I do not believe it can be intelligently disputed.

That the chemical changes produced by foods in this affection lead up to and produce disease in the stomach and bowels, and thus clog up the organs which should absorb, *is*, or should be, a well-known fact. The nerves that control these absorbing organs being paralyzed or partially so, the intestinal products flow into the blood-stream.

The reason some people who have tuberculous matter in their blood never develop tuberculosis is because of their great nerve power. The nerve power or fluid, or force, or whatever it is called—that current that flows over the nerves—is able, when reinforced, to cure more disease than food is. It is not considered often enough in treating disease. Stopping up the leaks of the nerve fluid, in order that one can store the more of this energy, makes them the stronger to overcome tuberculosis or any other disease.

The only other condition to add is that the conductors should then be in proper trim, and the patient skilled with the proper knowledge to distribute this force. This is where the physician's business comes in—to properly trim the wires. If he can do it the patient will recover. If the patient had the proper knowledge he could cure himself. Just as a great dynamo is set going when the wires are properly stretched and protected with the proper instruments in order at their termini, then everything runs smoothly and harmoniously. But if an instrument breaks or a wire loses its insulation and a short circuit is produced by large enough contacts, then the

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\* See Bibliography.

machine spits fire and stops—dies. Similarly does man's energy give out, his nerves cross, cause pain or possibly flashes before his eyes, he often sees stars, and, if force enough is used, he also dies. When we are born, just so much life is put into us, and no more ever comes.

If any of my readers are still inclined to hold that the microbe is the only means of diagnosing this disease (tuberculosis), I will remind them that here is a substance, a particular kind of matter, that you can see in the blood as soon as you put your eye to the instrument; it can be seen long before the tubercle bacillus can be found in the sputum or in any of the fluids or solids from the body.

I ask that you take this as a means of warding off disease. Take these granules in the blood as an aid to diagnosis where none other is at hand and consider it; if you will—well, consider it what you please, but use it.

The photo-micrographs, I hope, will make this matter plain.





PULMONARY  
TUBERCULOUS CASES.





## PULMONARY TUBERCULOSIS.

### ILLUSTRATIVE CASES.

#### CASE I.

The blood here represented is that of a physician sent me in April, 1899, for diagnosis.

I wish to say that when patients are sent me by physicians I seldom make a physical examination of the chest unless requested. My chief interest is in the appearance of the blood and not in general physical examinations.

The blood showed at once that the case was one of tuberculosis of the lungs.

Dr. Curtis afterward told me that his patient had been ill one year, had quite a severe cough and that there were rales heard over the chest. He was on his way to the mountains.

I show here several photographs of the same specimen taken at different intervals—about five minutes apart.

In the first it will be noted that the tuberculous matter is not only distinct but abundant. Fig. 16.

In the second, Fig. 17, the tuberculous matter has disappeared somewhat, as it naturally does on exposure to the air; and it will be noted that the contracting fibrin is making its appearance. Note its fineness. The red cells are clustered together in small bunches. The specimen, as a whole, is very characteristic of the disease.

The last two photographs, Figs. 18-19, show the fibrin and cells; the tuberculous matter has nearly disappeared. The white blood cells are increased in number here and are ameboid.

This is an advanced case. I have not seen the patient since, but I am sorry to say that he will not recover. He was 60 years old, and had done a large country practice.

\* \* \* \* \*

I have since learned that he lived one year.

Fig. 20 is characteristic tubercular blood.

## CASE II.

A friend brought in a gentleman 46 years old, as a patient for diagnosis and treatment. He had been away to the country for a few weeks, but it seemed to do him no good for he was continually losing flesh and getting worse rapidly.

This man was being treated with quinine for malaria. His temperature, he said, had been up to 102°. The skin was soft and damp. Because of his appearance and the lack of diagnostic symptoms, I began by examining the urine. The only symptom he gave was pain in the bowels together with the fever. The urine showed specific gravity 1,030, no albumen, no sugar, but a great proportion of biliary matter. A month previously he had suffered much from pain in the right iliac region, I should say where the ileum joins the cecum, or near the appendix. He had soreness there still. It is a wonder he had not been to a surgeon for operation.

Nothing of special import having been found in the urine, a drop of blood was taken and placed under the microscope. It is illustrated here, Figs. 21, 22, 23, 24 and 25. I give several photographs—two of the same drop two minutes apart, and three are of different drops from the same man—in order to show the general arrangement of this kind of blood.

The appearances clearly indicate that this man had tuberculosis of the lungs. Other photographs taken from the blood of this patient are shown on a following page.

On inquiring as to the existence of a cough, he said: "Oh, yes, I have had a cough for the last six months."

"Do you raise anything?"

"Oh, yes; in the morning."

A specimen of the sputum was afterwards sent to the Board of Health, and they found the tubercle bacillus. It was learned afterwards that he had fever and night sweats.

A physical examination of the lungs revealed the characteristic symptoms there.

The sunburn on the man's face, the pain in the side, and the statement made that he had malaria would naturally throw one off his guard. He died in six months.

## CASE III.

While coming up from the Thirty-fourth street ferry recently, some one hailed me in a happy tone of voice. I turned back in the crowd to see a stout young fellow fairly radiant with good health. I could not for the moment place him. Seizing my hand, he began:

"You doctors in Bellevue Hospital told me a few years ago that I had consumption. Do you remember? I was in bed there several weeks, and even left there nothing but a skeleton."

After thinking a minute, I recollected, and said: "Oh, yes; I now recall you, Mr. ———. It was the spring of '94. You did have consumption. I have a photograph of your blood to-day."

The record of that strong man's illness showed that he had had rales at the apex of both lungs and all over the left, together with much consolidation. He had profuse night sweats, and spat up much blood and mucus. The tubercle bacillus was found in his sputum. I think the case was complicated with pleurisy in its early stages.

Fig. 29 is a photograph of the blood as it was in Bellevue. The adhesiveness of the corpuscles will be noted; there is a slight increase in the white cells, and a faint outline of fibrin. The tuberculous matter is present in the serum in two places, but is somewhat faint, probably because the blood had stood so long before the picture was taken.

I may say that in this case the treatment was of little avail. Rest was the great requisite, and the fact that the boy was blessed with a robust constitution was a great factor. He went to the country, he says, and drank a good deal of milk. We all thought when he left the hospital that it was simply a case of time, and short time at that, for while there he apparently got worse instead of better. He came over to my office the day after I had met him, and Fig. 30 is the photo-micrograph obtained. You will readily see the change—no tuberculous matter, very little adhesiveness of the cells, and the white cells normal.

I would like to say that by the permission of Dr. Charles L. Dana I was that summer examining the blood of patients under the service of my brother in Bellevue Hospital.

#### CASE IV.

These pictures of blood illustrate two entirely different conditions which, from the physical examination, appear to be similar. They are reproduced here in order to show this special and not uncommon condition which I believe can only be made out by a blood examination.

Fig. 31 is from the blood of a woman sent to me by Dr. Ward B. Hoag. Two years ago the patient had a cough which lasted about a year. For the last few months she has been very well. There has been no cough and no night sweats at any time. At no time has she been unable to be about. Six weeks ago she was feeling as well as usual upon retiring, but in the night, on awakening, she noticed a peculiar feeling in her throat, and soon spat up some blood. The temperature was never over  $100^{\circ}$ . This condition continued a little at a time for two or three days. There was no expectoration of mucus at this time, yet two years ago there was very much. Tuberculosis was at once suspected. A physical examination revealed a dull spot over the left lung near the angle of the scapula. Mucous rales could be heard for two or three weeks in this region in a space about four inches in diameter, and there was also a spot on the right side. There was, no doubt, a hemorrhage from the lung. The microscopical examination of a drop of blood from the wrist revealed the condition as seen in Fig. 29; there was no tuberculous matter; the cells were fairly well arranged. In other fields not shown here crystals of various kinds and some fat globules were seen. From these facts, therefore, the case could not have been tuberculosis. The diagnosis in this case was a fibrous or sclerotic condition of the entire arterial system, particularly in the lungs. Of course, this woman might develop tuberculosis of the lungs, but if she takes good care there will



be no permanent injury. Only by persistently disobeying the laws of health can she acquire tuberculosis.

Fig. 32 is the blood taken from an Armenian woman sent me for diagnosis by Dr. G. Lenox Curtis. She could speak no English. The comparison of these two cases is very apt. The collecting of the cells in this case in small bunches, together with the tuberculous matter present, but not shown in this picture, tells at once that *this* woman has tuberculosis of the lungs. There can be no question about it, especially after the history of the cough is given. This woman has not long to live. But the former (note the difference in the arrangement of the red corpuscles) may live for years. When the former was told that her condition was not dangerous, the relief to herself and family can better be imagined than described. Confidence and hope sometimes are half the cure.

#### CASE V.

Mrs. O. has had a chronic cough for many years. When these two photographs were taken she was 75 years old, but did her own housework, in spite of the fact that she had slight hemorrhages occasionally, and great difficulty in breathing. The expectoration, of course, was full of pus-cells, but no crystals like those found in asthma. It was one of those cases of so-called "old-fashioned consumption of the lungs."

The circumscribed piling up of the red cells is very characteristic of this hemorrhagic fibrous consumption, and is well shown in this photograph, Fig. 33, which was taken in 1894. It is useless to try to describe this picture, for it can really best be understood by observation. It will be noticed that there is no tuberculous matter here, for this case is not that form of the disease. Still, it is present more or less when the tuberculosis exists as a complication. The woman had this affection twenty years or more, and died of this disease in 1899, after having been confined to her bed several weeks.

## CASE VI.

## INHERITED TUBERCULOSIS.

Through the courtesy of Dr. E. A. Tucker some years ago, I was allowed the privilege of examining some infants of tuberculous mothers in the Sloane Maternity Hospital. The doctor was kind enough to telegraph me when a child was born, and then I had the privilege of making the examination of the child's blood before it nursed. Out of about 11 cases of births from tuberculous mothers, I remember to have found only one infant in which the tuberculous matter was not found.

The following are very poor photographs—a mother's blood, Fig. 34, and her babe, Fig. 35, showing the tuberculous matter in both.

Note the short rouleaux, which are characteristic of infants' blood. The infant's blood is the nearest approach to health, and is, therefore, used as the standard.

## CASE VII.

## FIG. 36.

In 1894 a gentleman wanted to send me a test case. He, therefore, sent a young lady about 17 years old who had a severe cough, and was emaciated and anemic. She had been for a long time under the care of a physician, who was treating her for tuberculosis of the lungs.

Referring to the photograph, it will show that the blood is perfectly free from tuberculous matter, and is otherwise in very good condition. She was told that her lungs were all right; that there was no tuberculosis. She went home, stopped taking medicine, and is to-day a stout and healthy young woman. The relief from the idea that she had tuberculosis acted like a tonic, and it was the change of her belief that acted as the remedy. Fig. 36.

## CASE VIII.

## RECOVERY FROM TUBERCULOSIS.

This gentleman, whom I had known for many years, is of medium height; his occupation for many years was that of a teacher and student of literature, and he was subject to great mental strain. Naturally, he did not have a robust-appearing constitution. His occupation at the present time allows him more leisure; thus, he has more opportunity to take care of his health, and his physical appearance indicates that such is the case.

The arrangement of the blood here illustrated shows it to be that of about as perfect health as can be, so far as the arrangement of the cells is concerned. The proportion of white to red corpuscles is normal and the color is good; there is 95% hemoglobin. There was no tuberculous matter whatever and the movement of the cells *en masse* was very good. The rouleaux are marked and the adhesiveness of the cells is slight. They are quite elastic. Therefore, it can be said of this man, from the blood here shown, that his vitality is good. He has little or no articular rheumatism. There is no tuberculosis and no predisposition to it. It would, therefore, at his age (about 44), be difficult, if not impossible, for him to acquire tuberculosis in any form; and his prospects, so far as the blood shows, are for a good, long life.

Eighteen years ago this man suffered from hemorrhages, cough and expectoration, together with shortness of breath, emaciation and great weakness. He was so ill that his physician, Dr. A. L. Loomis, advised him to go to the south of France with the prognosis of recovery doubtful. His condition was such when he arrived in Mentone that his end was expected at any time. Dr. Loomis' diagnosis was tuberculosis of the lungs. This illustrates another case of recovery of this dreaded disease. Fig. 37.

## CASE IX.

## ULCER OF STOMACH.

It is impossible in a book of this size to give all the diseases or all the modifications of disease that are capable of being discovered or differentiated by the blood examination. Often a trivial query, and either a positive or negative reply, will aid more in getting at the true disease than is at first thought possible. The photograph following is one of the negative results that in connection with the examination of fresh blood sometimes settles a point of serious importance to the patient.

This man, about 40 years old, had for at least a year been suffering with hemoptysis. He said he did not cough, but the blood simply came up. He was emaciated and very much run down. He naturally thought that he had tuberculosis of the lungs. He had no night sweats, but it is not necessary for a person to have that symptom in order to have tuberculosis. The blood, it will be noted, was free from tuberculous matter, and the arrangement of the cells is more that of rheumatism than consumption. The fibrin is more of the normal variety, and it will also be noted that there are a number of microcytes—dwarf red cells—in the photograph.

But what I want particularly to call attention to is the absence of tuberculous matter. Fig. 38.

The diagnosis in this case was ulcer of the stomach. After a year's treatment the man made a good recovery.

\* \* \* \* \*

A microscopic examination of the expectoration was afterward made, but nothing but blood and pus-cells was there.

The blood in this case was of value as a negative diagnosis; i. e., it eliminated what it might have been, and the rest was settled by the diagnostic ability of the physician.

It is here, again, well illustrated that the hematologist should not only be a general practitioner, but that he should continue to keep posted on all diseases.



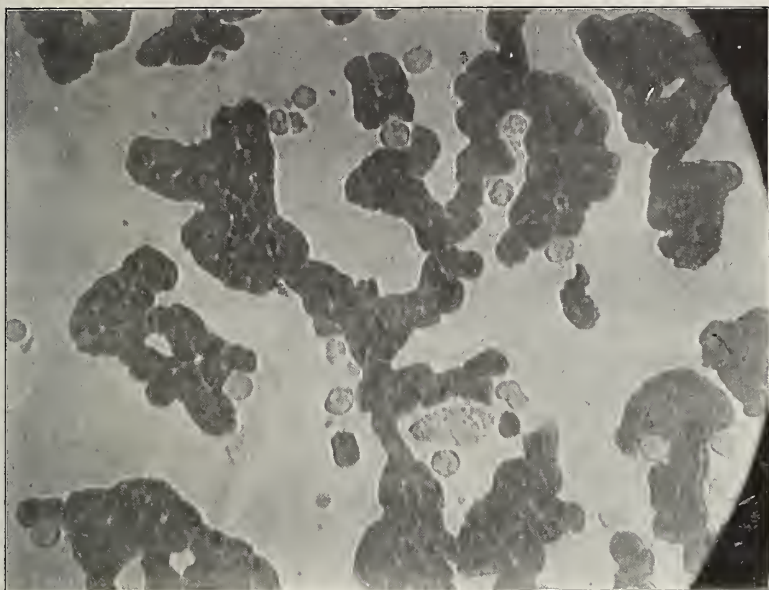


FIG. 16.—Fresh specimen, showing tubercular matter.

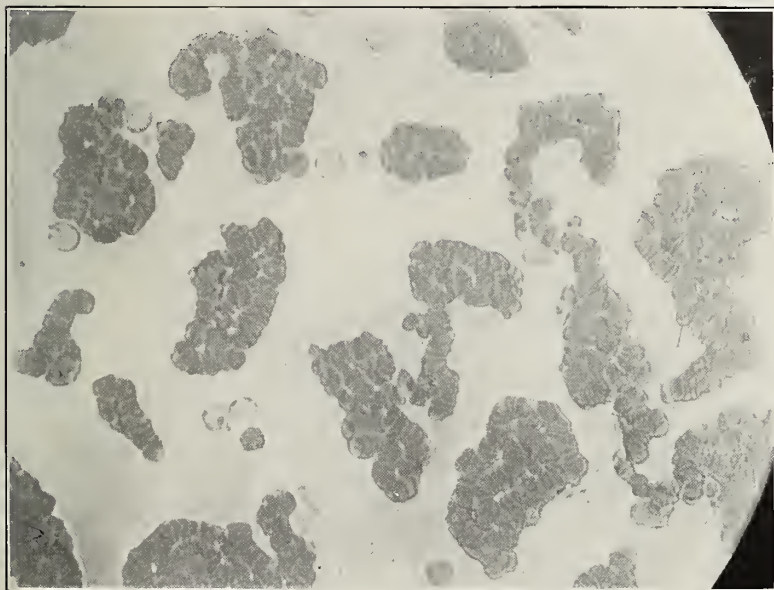


FIG. 17.—Same as Fig. 16, two minutes later. Tubercular matter disappeared.



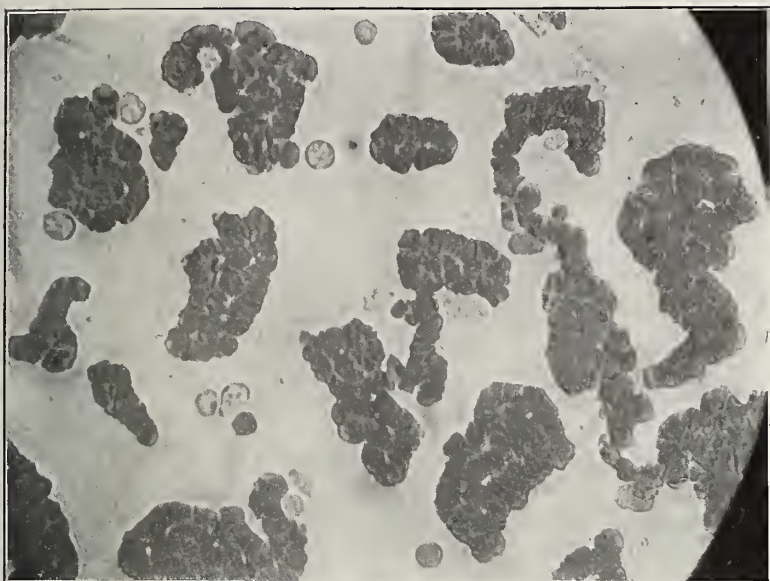


FIG. 18.—Five minutes after last—fibrin is making its appearance.

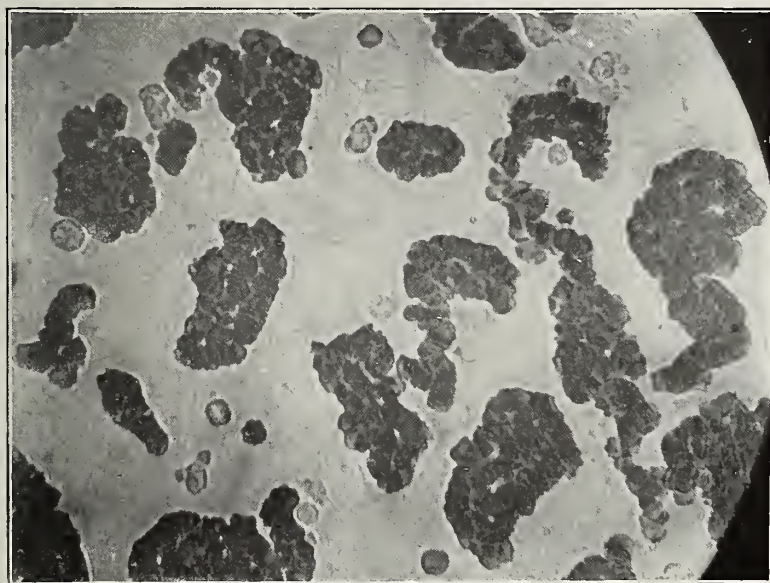


FIG. 19.—Fibrin still more plainly seen ten minutes after above.



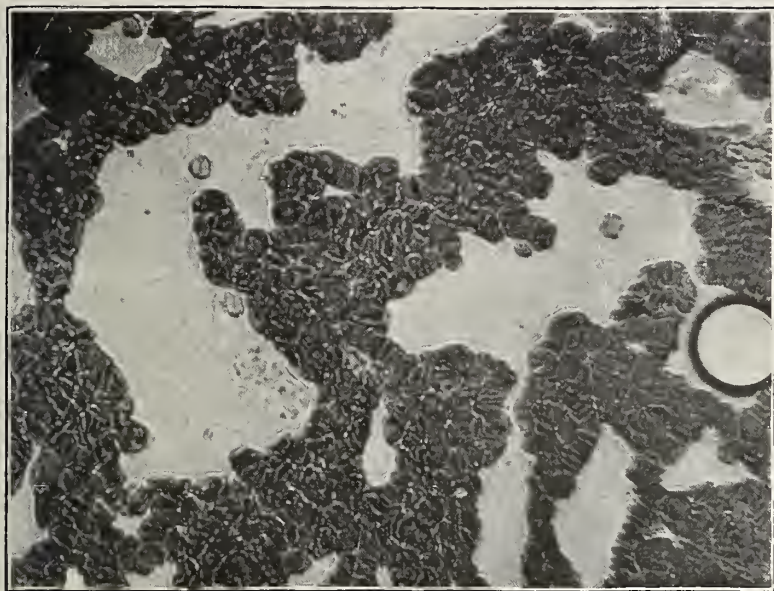


FIG. 20.—1.9 obj. Tubercular matter and fibrin plainly seen in the fluid portion of the blood.

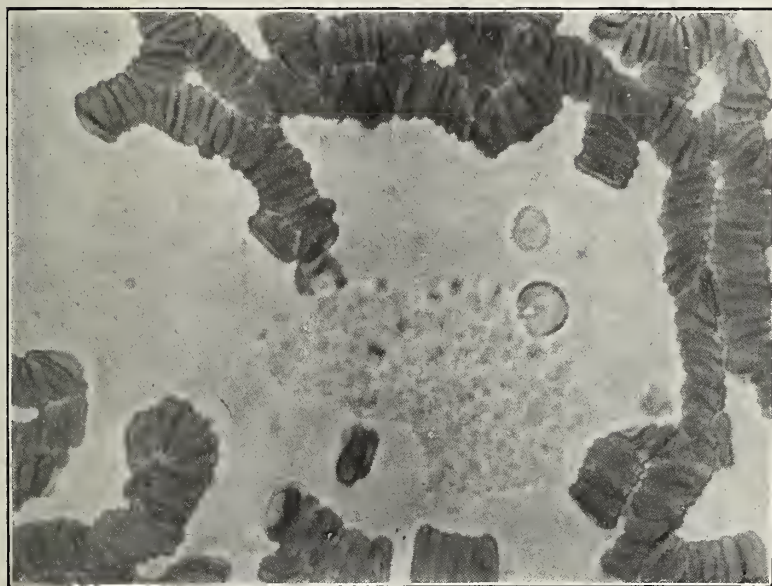


FIG. 20½.—1.12 obj. Showing tubercular matter.





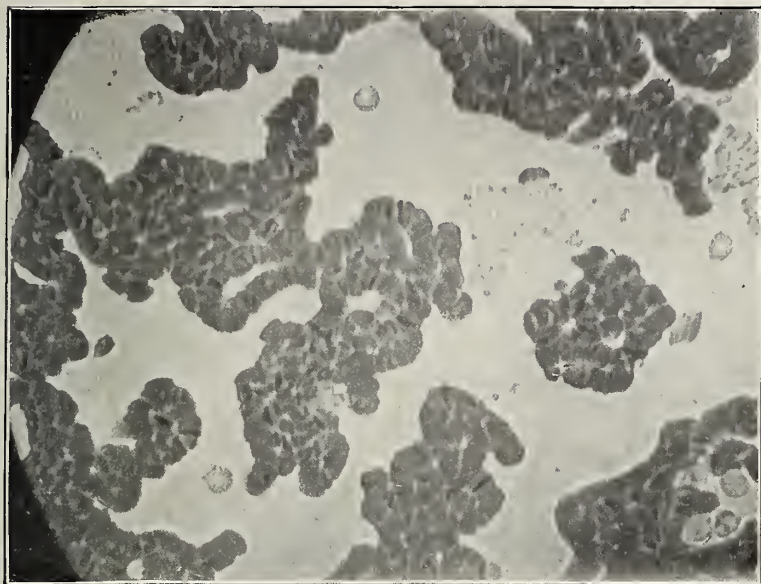


FIG. 21.—1.9 obj., Case II. Tubercular matter. Photo one minute after drawing.

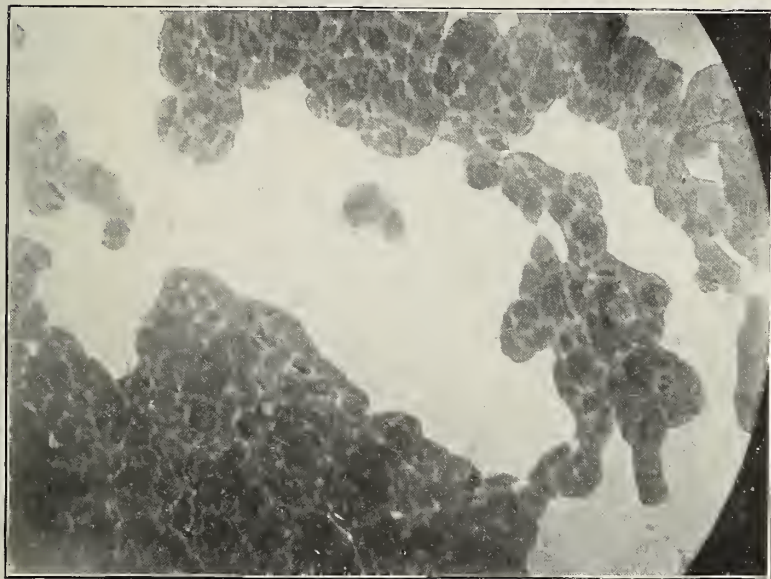


FIG. 22.—1.9 obj. Two minutes after Fig. 21.





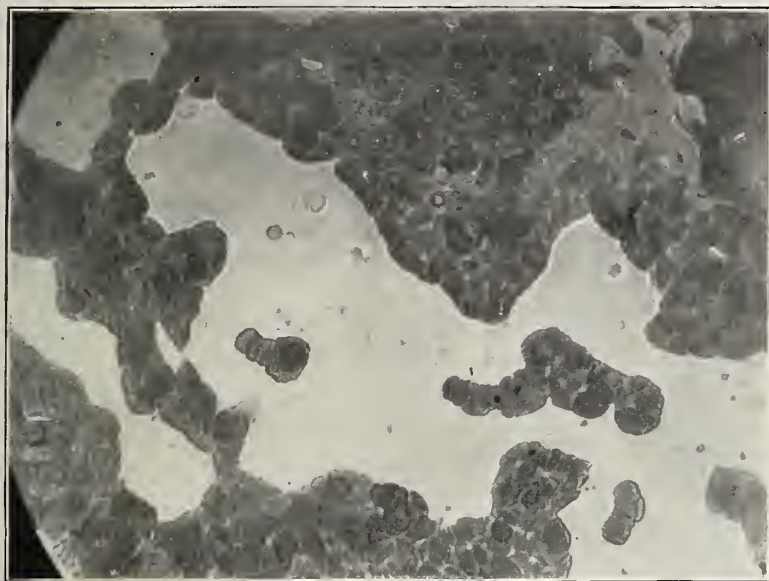


FIG. 23.—1-9 obj. Blood cells still slowly moving. Photo taken two minutes after Fig. 22.

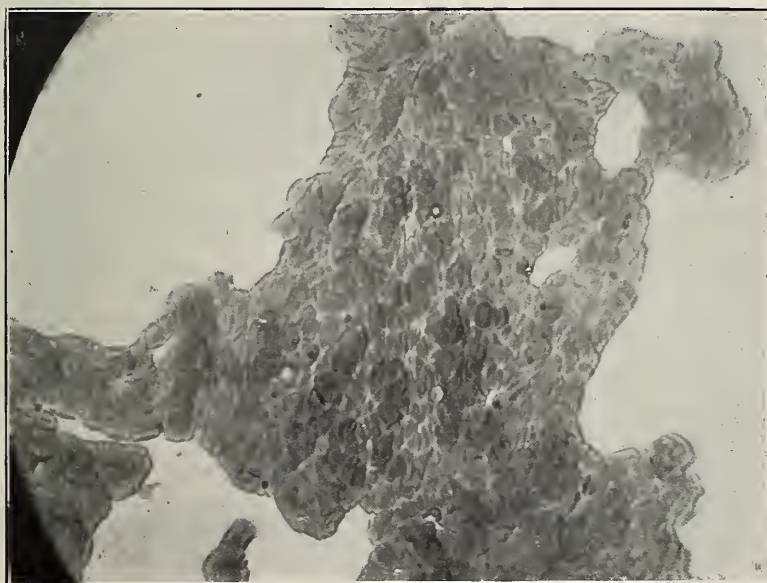


FIG. 24. 1-9 obj. Same specimen as Fig. 23 but different field.



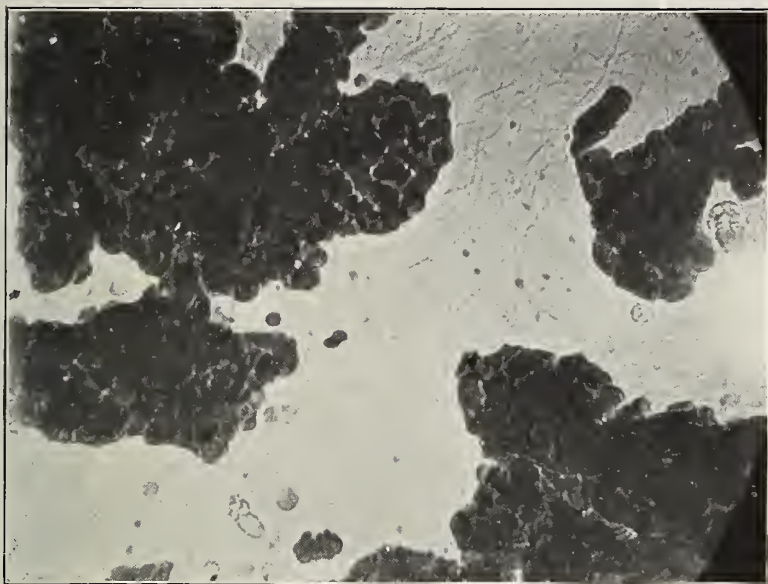


FIG. 25.—1.9 obj. Five minutes after Fig. 24. Fibrin now plainly shows.

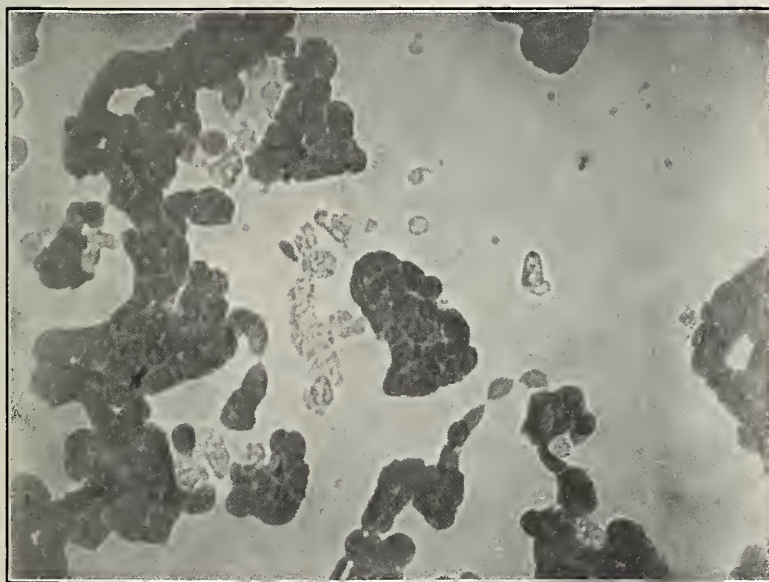


FIG. 26.—1.9 obj., Case II. Two weeks after first examination.



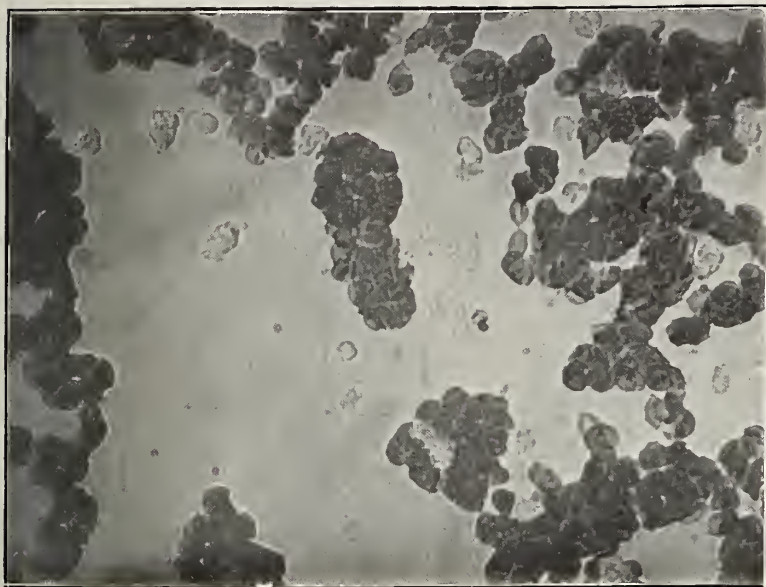


FIG. 27.—1-9 obj. Two minutes after Fig. 26. Tubercular matter still faintly seen in the field.

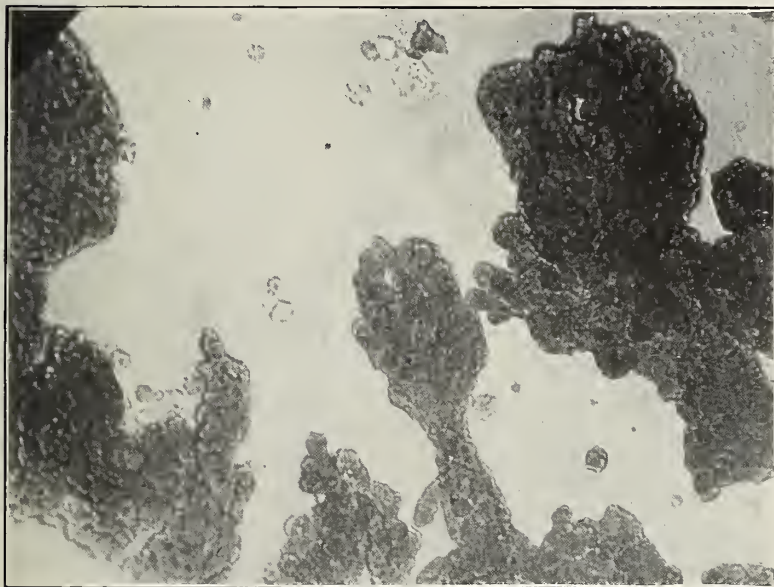


FIG. 28.—Later still, showing the fibrin.





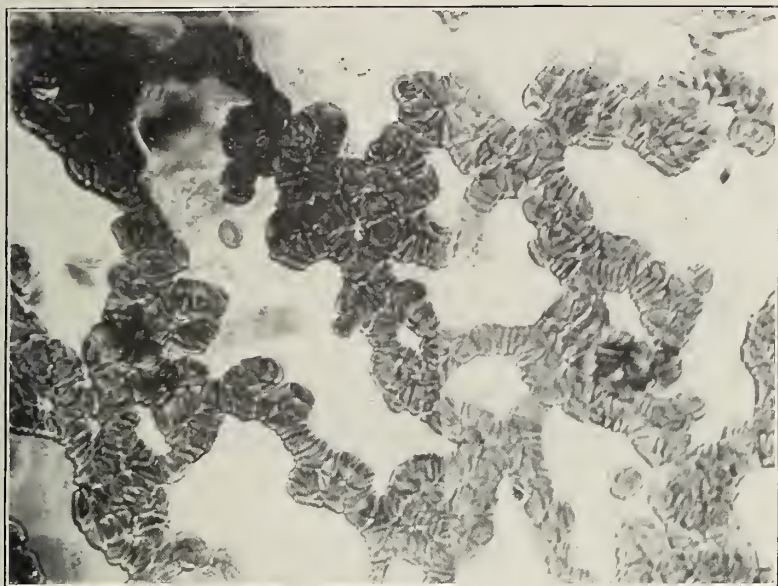


FIG. 29.—Bellevue Hospital case. See Case III.

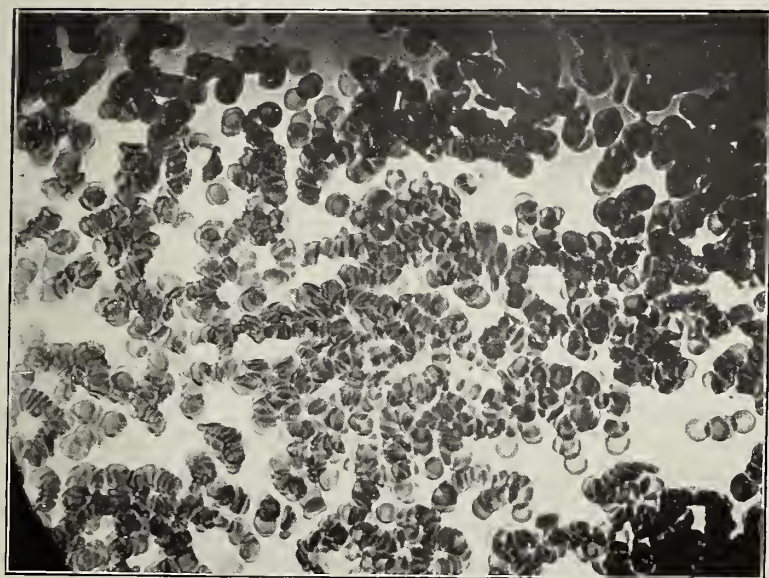


FIG. 30.—Case III. After recovery.



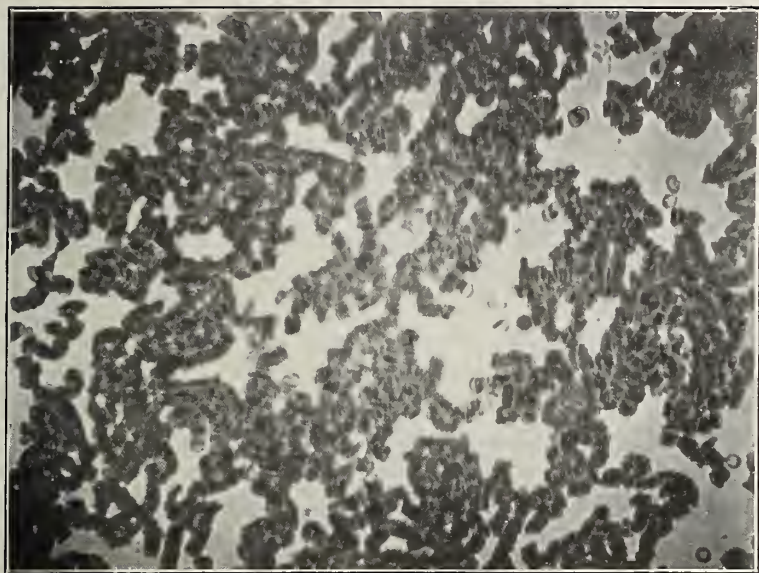


FIG. 31.—Case II. Patient thought she had tuberculosis, but photo shows she did not.

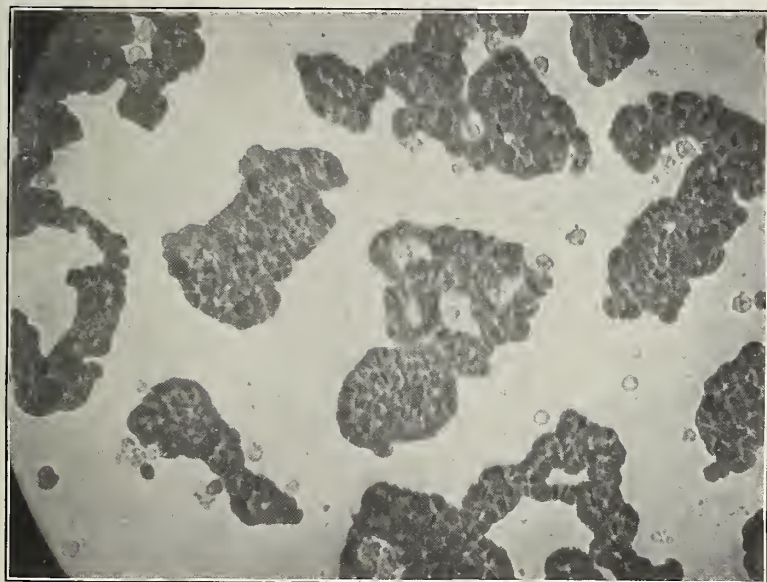


FIG. 32.—1-6 obj., Case IV.





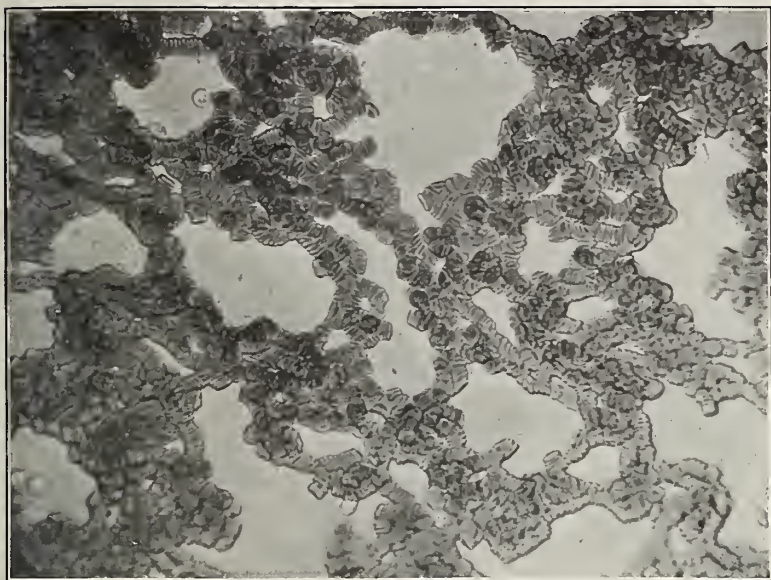


FIG. 33.—Case V. Illustrates the fibroid arrangement of cells.

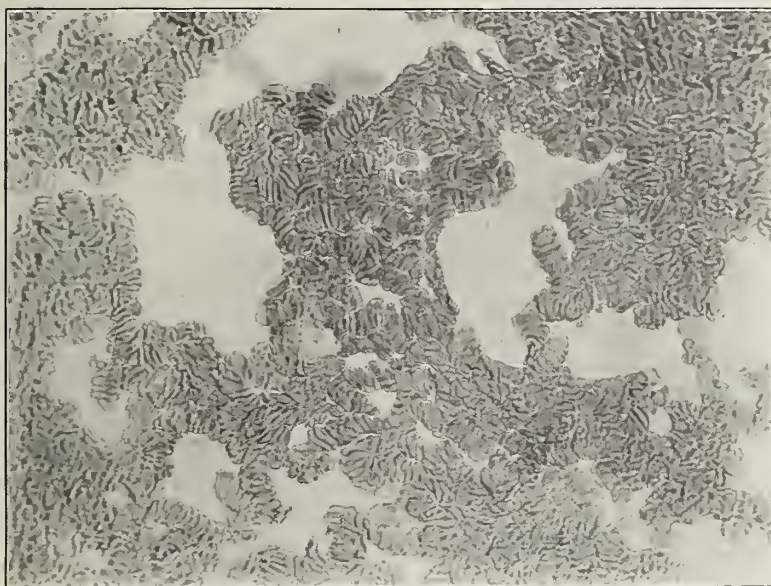


FIG. 34.—Tubercular mother's blood.

Figs. 34-35 show that Tuberculosis is transmissible from mother to child.



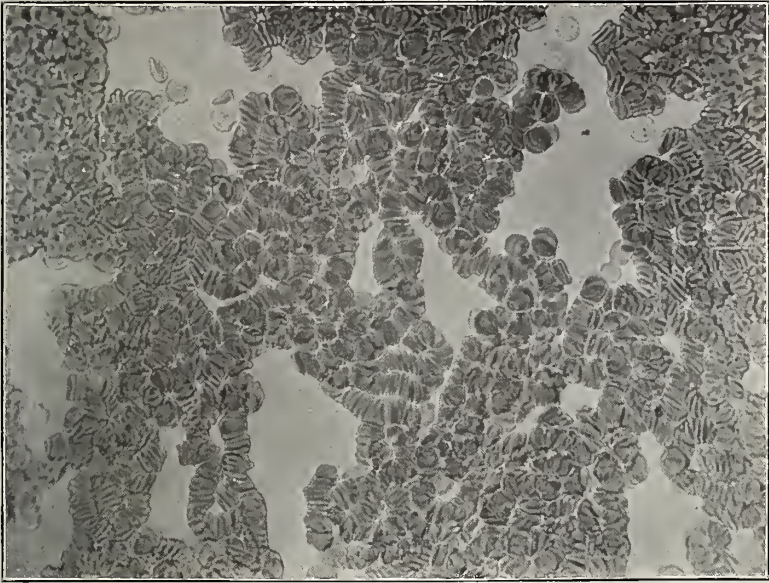


FIG. 35.—Case VI. Child's blood slightly tubercular—upper left corner.

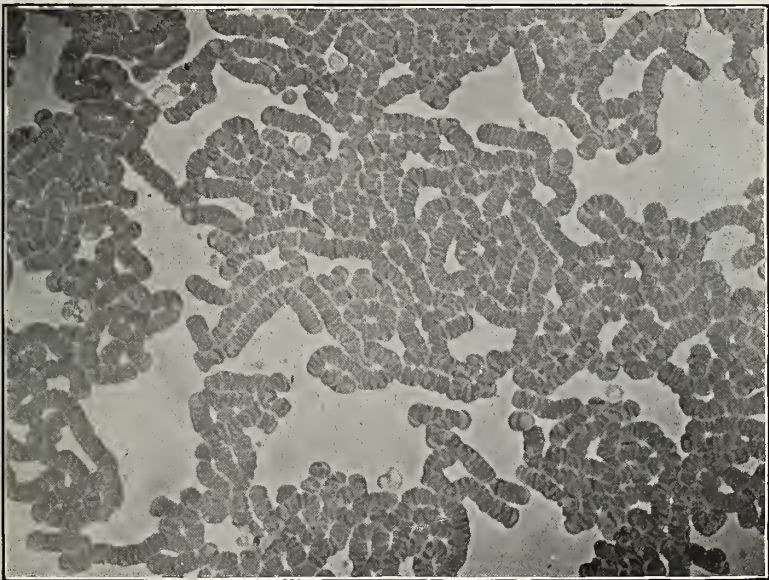


FIG. 36.—Case VII. A test case.





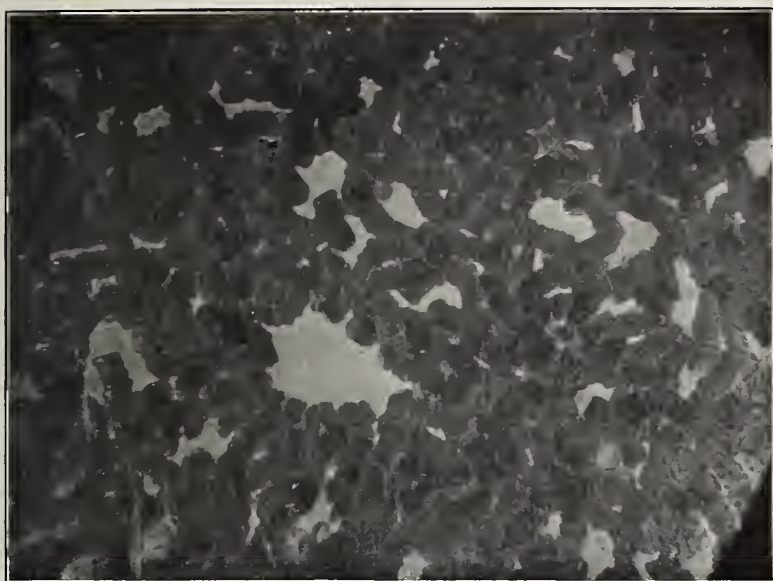
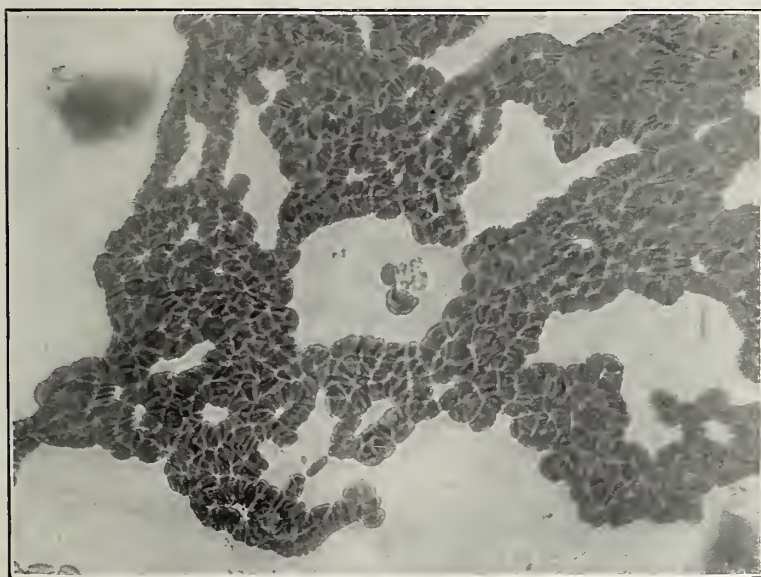


FIG. 37.—Case VIII.



Blood from a woman with lupus, showing that this disease is of tubercular origin and visible in the blood.



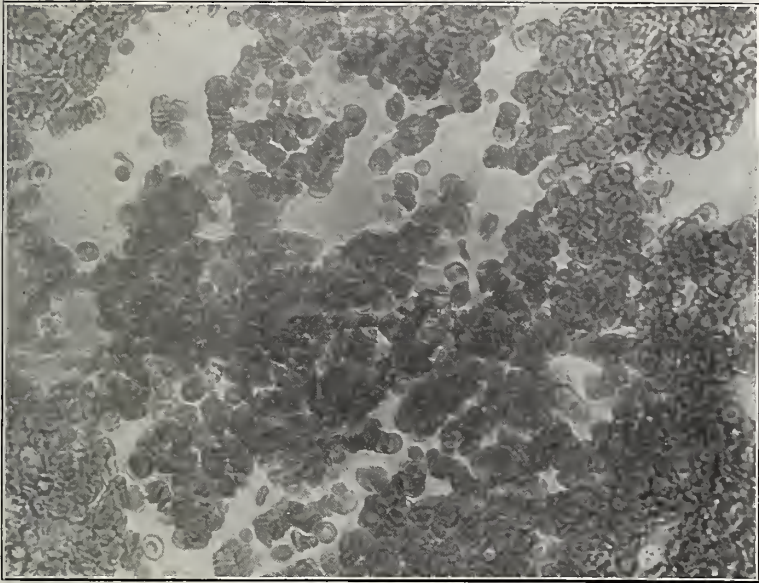
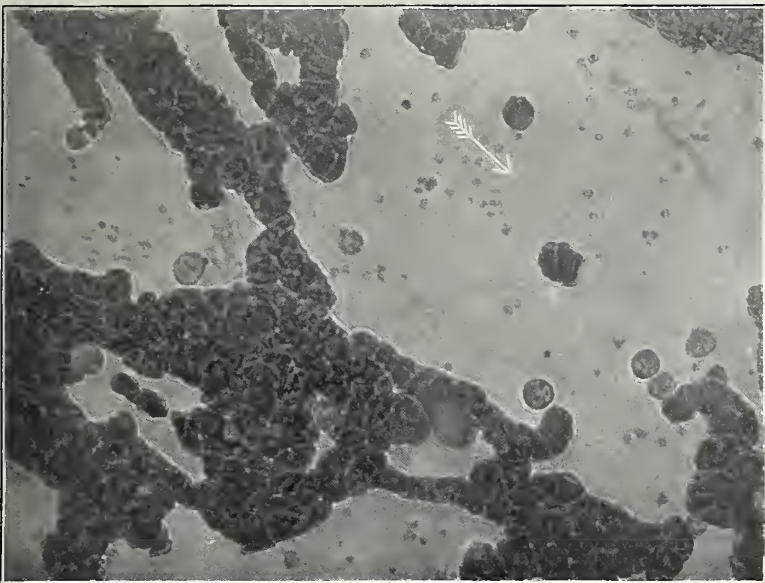


FIG. 38—1-6 obj., Case IX.



The bacillus in the photograph is in contact with the only tubercular matter in the field. It is quite faint, it being difficult for the engraver to reproduce such a small single object. This germ is also shown under miscellaneous.



# SEPTICEMIA

(BLOOD POISONING.)





The blood poisoning illustrations here shown are all taken from puerperal cases. Under the head of miscellaneous will be found one or two photographs taken of other forms of blood poisoning. There is a general look, however, about all of them, indescribable, but characteristic.



## SEPTICEMIA.

In the limited number of cases of this disease that I have seen I have observed that the blood shows a great amount of serum at the expense of the red corpuscles.

There are many cocci (germs) scattered throughout the field. The appearance is well illustrated in the two pictures here reproduced, and is characteristic. Figs. 39 and 40.

The red cells are scattered throughout the field of the microscopic specimens and seem to float and turn over on themselves in a lazy, careless kind of way without showing any flabbiness or poikilocytic tendency, while the individual cells simply float idly about, becoming finally stationary, and give a peculiar anemic appearance, which can be recognized only by one having long experience in examinations of fresh blood. One gets the same idea from the behavior of the cocci in this disease as they do from the red cells.

The first photograph is the blood from a young woman after a miscarriage. She was in the maternity ward of Bellevue Hospital, on February 28, 1895. This was the third day after entrance, when the temperature was 105°. She made a good recovery. The pre-tuberculous condition was present and more marked than is shown in this picture.

The second photograph here is from Mamie W., 22 years old, who was confined in Sloane Maternity Hospital. On the 12th day she developed a fever and the thermometer indicated 104.7%. There was no special cough, but the irregular temperature before this made Dr. Tucker suspicious of a tuberculous complication.

After a few days, when the temperature was down to 102°, the blood was examined and the photograph here shows its septicemic, as well as its pre-tubercular condition.

I remember a physician's wife whom I examined about this time—February 27th, I think. It was thought that she undoubtedly had blood poisoning, and that the streptocci would be found in her system in abundance. About the tenth day after confinement she had been taken with a fever which was very persistent and uncontrollable. She had a slight cough and, finding such an abundance of tuberculous matter

present in the blood, I was fearful at the time of tuberculosis of the lungs or general tuberculosis. She, however, made a good recovery, and remains well to-day. If, then, I had been as well informed on fibrin as to-day, I would have known that her blood disposition pointed more toward the rheumatic or fibrous formations than toward lung tuberculosis. The fever will often hide this fact, and one must be careful to take everything into consideration.

It is well to remark here that I have never examined the blood in a case of septicemia yet, that it did not contain tuberculous matter. The question would naturally arise: May it not be that pre-tuberculous women are more prone to blood poisoning after a confinement or an abortion than others?

If that should be found to be the case, it would be in order, perhaps, to say that non-tuberculous parturient patients are immune to septicemia.

I remember, years ago, when in general practice, to have delivered a poor woman, at least 45 years old, of her first child. My hand, when placed over the uterus during the course of the labor, and even when this organ was contracting after delivery, felt many small nodules or knots. The woman had the best attention she could afford, but, in spite of everything, she developed septicemia and died inside of a week. I have since thought that she was tuberculous, and these were the nodules I felt. She was also addicted to the use of stimulants.

The same year, 1895, I was called to examine the blood of a fine, handsome and really healthy-looking woman for Dr. E. Bradley, a well-known practitioner of this city. She was having an unaccountable and irregular fever, the cause of which several consultants could not determine. The tuberculous blood was plainly visible on examination.

An operation—an exploratory incision—was performed by Dr. H. D. Hanks to see if there was uterine or ovarian trouble, and a pus tube was found. The wound was closed, but blood poisoning set in and the woman died.

I simply mention these cases which came under my observation, without intending to convey the impression that such results always follow.

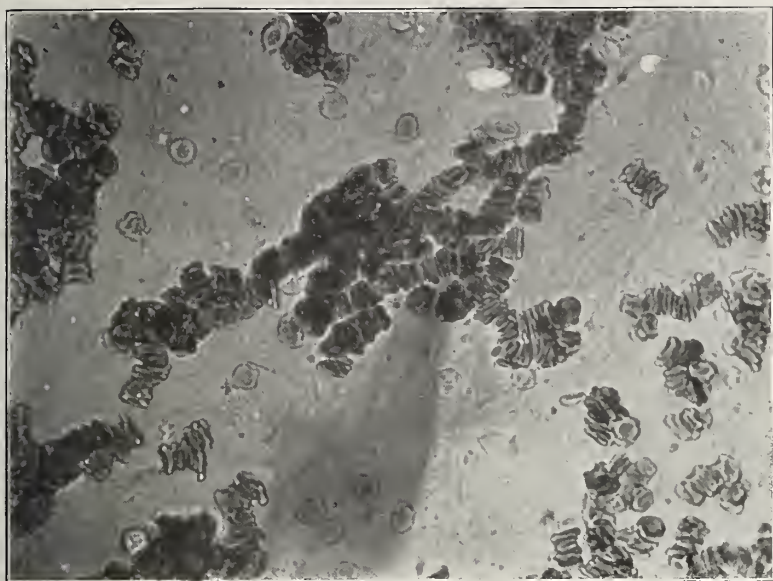


FIG. 39.—Blood poisoning.

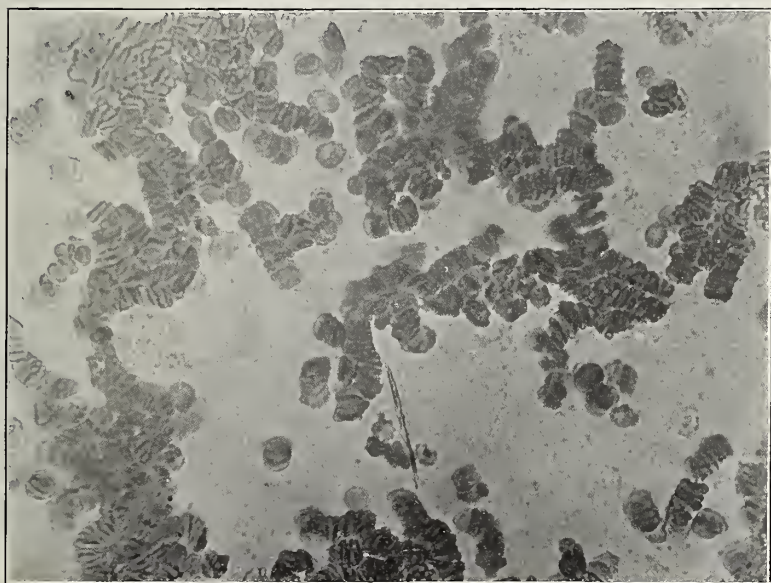


FIG. 40.—Blood Poisoning.  
Also see Fig. 116½, p. 339.



BLOOD IN RHEUMATISM.





Rheumatism shows in the blood whenever it is in the system, whether or not the person has an attack at the time of examination.



## FIBRIN-RHEUMATISM.

Fig. 41. The first photograph here shows normal fibrin as seen in the serum of the blood. It is composed of fine short filaments rather closely packed and resembling a spider's web. It pervades the entire arterio-venous system with its invisible network, existing in the brain, the lungs, the heart, the stomach; spreading through every organ and capillary of the body, ever circulating and performing its function, which is as distinctive and as essential as that of the red or the white corpuscle. Thickened fibrin is one of the pathological conditions of the blood.

It is this thickened fibrin which collects the various crystals and insoluble particles that pathologically exist in this ceaseless river of the system as it splashes its contents against some sensitive neuron or its dendrite, and finally deposits them on the valves of the heart, or swashes its ingredients into some non-anastomosing vessel or capillary, or into some already painful joint. If the former deposit occurs in sufficient quantity, we have valvular disease of the heart; if the latter, it is rheumatism of the joints.

The red blood cells float in the centre of the blood serum in the capillaries, and the white cells, together with the fibrin, float next to the wall of the blood vessel. Because the fibrin is next to the capillary wall, and because physicians have not squeezed the blood out of the wound and thus obtained the fibrin, are reasons why they have only occasionally seen this network in the blood when they have examined it. It is the contracting of this fibrin which causes the pain when a rheumatic is exposed to a draught, and it is its contraction on exposure to the air that makes it visible. It is the elastic contracting and expanding of this fibrin which causes the corpuscles under the microscope in freshly drawn blood to slowly sway backward and forward.

In rheumatism the fibrin filaments are longer and much thicker than normal. Fig. 44. Therefore, the fibrin network

spaces are closer together. In rheumatism the red cells adhere and pile themselves on each other as seen in the photographs. See Figs. 42 and 43.

There are crystals of various kinds in rheumatic blood. Rheumatism, then, may be defined as a thickened condition of the blood elements, together with the presence of various salts and crystals. From this it may be perceived that there are various forms of rheumatism.

There is uric acid rheumatism, in which uric acid crystals are seen in the blood. These have been very ingeniously separated by Garrod,\* of London, by placing threads of silk in the blood, and allowing the crystals to collect. This procedure is not necessary, however, in all cases, for if the blood is saturated with uric acid any excess is insoluble in the blood, and will crystalize out. It is then perfectly visible under the microscope. See Figs. 56 and 57.

There is phosphatic rheumatism (Fig. 53). There is rheumatism due to an "excess of oxlate of lime. Cystin crystals are seen in Figs. 58 and 59, and cystinic rheumatism in Fig. 60. Fig. 61 is uric acid.

The most common varieties are probably uric acid and cystinic rheumatism. These deposits occur slowly for years, almost imperceptibly, clogging up the joints, until the patient has what is so well known as articular rheumatism, and, finally, arthritis deformans.

These crystals may deposit in any joint and produce pain wherever they occur. The cystin often deposits in the encephalon, producing rheumatic headaches. Crystals of cystin have been so little written about and much less known, because no one has called the attention of the profession to them, that I shall quote\* for the benefit of those who may never have had their attention called to these recently recognized crystals which are so very common in rheumatics, and are the cause of the cystinic variety of this disease:

"Cystin is insoluble in water and alcohol. It is dissolved by the mineral acids and oxalic acid, the fixed alkalis and

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\* See Bibliography.

their carbonates. It is soluble in ammonia, from which it is deposited, unchanged, on the evaporation of this volatile alkali, but is insoluble in carbonate of ammonia; hence, it is best precipitated from its acid solution by that reagent and from its alkaline solution by acetic acid. It is hexagonal in its crystalline typical form.

“Its presence in the microscopic examination of blood is solely determined by its well known and characteristic appearance in the urine. No other crystals found in the blood or urine are at all likely to be mistaken for cystin, whatever their form or departure from their strict type may be.

“When the rays of light from the mirror of the microscope pass at right angles through the face of the crystal, it appears bright and clear like glass. The rays of light that strike the crystal at an oblique angle cause such surfaces to look black, so that the crystal is made to have very clean-cut sharp lines.

“The hexagonal form has been found in the substance of the liver, but in the blood the crystals are mostly irregular or seldom hexagonal, due probably to their floating about and rubbing the walls of the blood vessels. The crystals are very friable, and often are seen in the blood as crystalline particles, grouped, but whatever their form or whatever their size, seen either singly or *en masse*, the crystals never lose their characteristic appearance. Sometimes a crystal is found in the blood so obscured by the coloring matter of the blood, or so enveloped in blood cells or broken-down epithelium from the walls of the blood vessels, that nobody can tell what particular kind of crystal it is. Cystin calculus is very rare, in spite of its total insolubility in pure water, and also on account of its slow elimination from the kidneys, while other gravel-forming substances are often eliminated in large quantities at a time; e. g., uric acid and the urates, phosphates, oxalate of lime and carbonate of lime.

“Cystin does not pass into the tissues, except in solution. The cystin that appears in the urine as crystals comes from the Malpighian bodies, but cystin in the urine generally occurs in the granular form. It can often be seen with the unaided

eye. If very abundant, the urine may look milky. Seldom, even in bad cases, are heavy deposits found daily.

“By ‘cystinemia’ is meant such a collection of this peculiar compound in the system as to produce any great disturbance of the body. This condition results in various forms of disease. The formative departure is in the alimentary canal. Later on, the blood becomes thick and ropy.

“Cystin may be excreted by any of the mucous surfaces, especially the kidneys, the bronchial tubes and the epithelial surfaces of the bowels, but cystin in all these cases is always found in the blood, sometimes found in the urine, expectoration and the faeces. Its local manifestation is only a symptom of the systemic condition.

“Cystinemia is apt to affect the nervous system, often producing great nervousness and also paralysis. It produces bronchial catarrh, and when affecting the smaller bronchial tubes produces asthma.

“By reason of its production of thick and ropy blood it produces rheumatism.

“Cystinic rheumatism is more apt to enlarge the joints than any of the other varieties of rheumatism, owing to the insolubility of cystin by the ordinary remedies given for the other forms of rheumatism.

“Cystin produces a gouty condition of a chronic form. It does not produce acute rheumatism. Its presence in the blood is rarely absent at any examination of a marked case of this disease. Its presence in the urine is not constant even in bad cases, and probably this is why cystinemia is often overlooked by many physicians who seldom examine the urine of their patients and never examine their blood.

“There seems in some cases to be occasional storms of elimination of cystin, either by the lungs or bronchial tubes, the bowels or the kidneys. Many times the urine becomes so loaded with cystin that the whole excretion will look like milk. This milky appearance is not caused by the hexagonal crystalline form of cystin, but the amorphous.

“To prove that this granular matter is cystin and nothing



else, we have only to precipitate the amorphous to the typical form by the well-known reagents. These storms of elimination or 'explosions' of cystin from the system are generally followed by a sense of relief to the patients, especially to those of a neurasthenic type. They experience in a degree a sort of temporary *bien etre*, yet they do not know why they feel better any more than some people do after a good cry and a liberal flow of tears. These persons seem to rival Niobe in their weeping, barring the difference in the cause.

"When cystin attacks the epithelial surfaces of the bowels it often produces chronic diarrhea. Frequently there is pronounced dyspepsia—congestion of the portal system and dizziness. Virchow found cystin in the liver. It has also been found in the lymphatic glands and spleen.

"In old times the iridescent pellicle of cystin, sometimes observed on the top of urine after standing a few hours, was regarded as a sign of pregnancy, but unfortunately for the theorist who started this notion, such a condition equally obtains in the urine of both sexes. The neurasthenic type of cystinemia is often called hysteria for want of a better name, but men have hysteria as well as women from cystinemia.

"In the asthma produced by cystin the crystals are often dark, like coal dust, but the proof that these crystals are not coal dust is the fact that they are largely found within the cells of the epithelial surfaces. The condition constitutes gravel of the lung.

"Cells do not take up solids except in minute forms, e. g., emulsified fats. Moreover, in cystinic asthma the blood always, and often the urine, shows plainly the cystinic condition at the bottom of the trouble.

"In spermatorrhea, uterine and vaginal catarrh, cystin often appears. For the two latter conditions curetting and douches give only temporary relief. This leakage and catarrh returns and persists till normal digestion and metabolism is restored. Treat the patient's systemic condition, and the little side issues take care of themselves. Palliative treatment is all right, but it never removes causes. Although cystin contains

25% sulphur, the writer has not observed that the giving of sulphur by itself, or as it exists in certain foods, has anything to do with the production of cystin. It is, however, a fact that foods rich in sulphur often disagree with persons having cystinemia, e. g., they will observe that eggs and fish, both rich in sulphur, aggravate their subjective symptoms."

From this pathology it will be seen that rheumatism should not be considered an acute disease, having a limited and definite time to run. It should be treated with the intention of getting these crystals out of the system and reducing the amount and thickness of the fibrin. In order to do this, one must know what kind of crystals are in the system. To go into the details of this is beyond the limit of this work, but the stages of recovery in one case is here shown by means of photographic illustrations. It will be noticed that the thickness or adhesiveness of the blood cells decreases as the fibrin and crystals leave. Fig. 47. It is a picture of the blood of a woman 65 years old, who came to me not only with rheumatism but diabetes. Her prominent symptoms were stiffness and numbness of the toes and fingers, together with distress in the stomach. Fig. 48 shows the blood after one month's treatment. She said the numbness in the toes left slowly, but steadily, and one day when bathing her feet it went altogether. It has never returned up to this time. It will thus be seen that the effect of remedies can be watched by the blood examination when its pathology is properly understood.

In closing this subject, which has been only lightly considered, it must be evident that this should open a new line of thought. With these facts before us, how can the germ theory of this disease ever be considered? It is much talked about, but it cannot be thought that it will bear close inspection.

NOTE.—Rheumatism has been known by physicians for many years to be a precursor, "forerunner, advance scout," of cardiac lesions. Therefore, the photographs of heart disease will follow in this section, for these demonstrate that the constituents of vegetations on the valves of the heart exist in the blood long before, as well as after, the disease is well seated.

## CASE I.

Fig. 45 and Fig. 46 illustrate the rheumatic arrangement of the cells, and also the thick fibrin under a high power.

Dr. Wm. H. Katzenbach was called in consultation in this case, and it seemed to be a peculiar form of paralysis. The man was taken suddenly, but recovered partially, and finally died by degrees one year after the first attack. The rheumatism was in the blood, but showed itself in the usual way very slightly during life.

## CASE II.

Some years ago I was treating a patient about 55 years old for rheumatism, together with the premonitory symptoms of apoplexy and paralysis. The pain in the joints was of an aching character, and limbs were getting more stiff. It was apparently getting to be a case of arthritis. The patient got so bad after a time that confinement to the house, and even bed, was necessary. The heart was subject to palpitation, yet I could find no lesions there.

We finally decided to call Dr. Alfred L. Loomis to see the case. Dr. Loomis came and made one of those brilliant diagnoses—such as have made him famous. He said the patient would live—though she was very low—and that “there were fibrin filaments passing through the valves of the heart.”

How many men could have made such a diagnosis? How many men have had the ear to hear? I remembered the words well, for I had previously examined the blood, found the filaments of fibrin greatly thickened and elongated, and I now reproduce them here. Fig. 49. Dr. Loomis knew not of my work, nor did I inform him. The patient lived, got well, and there was no cardiac lesion perceptible to others.

The fibrin skeins are readily seen. The cells of the blood are dry and thus the fibrin skeins appear more massed than is usual.

## CASE III.

Some weeks ago I examined the blood of Miss Sadie Martinot, the actress. I casually showed her the photograph of Max O'Rell's blood, brought to me for the purpose of photographing it by his physician, Dr. J. W. Moore. Miss M. said: "Now, if you ever publish that, just place mine along side of his (I met him in Paris some years ago), and say that this is Max O'Rell's and that Sadie Martinot's."

The blood of Miss Martinot contains the crystals of cystin, showing the incipient stage of cystinic rheumatism. Fig. 50.

Max O'Rell's, at this time, shows the healthy arrangement that his physical appearance indicated. Fig. 51.

The photo-micrograph was taken with a Tolles one-sixth objective, non-photographic, and, hence, presents a very flat field.



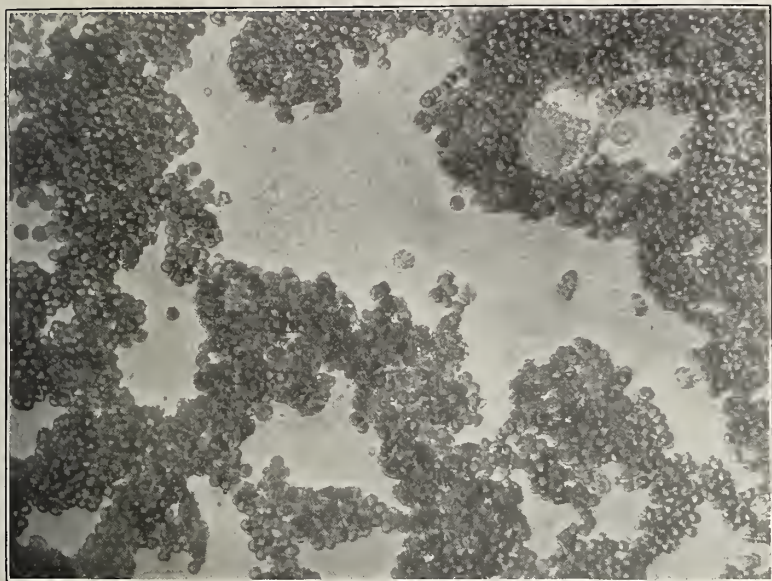


FIG. 41.—1-6 obj. Normal fibrin.

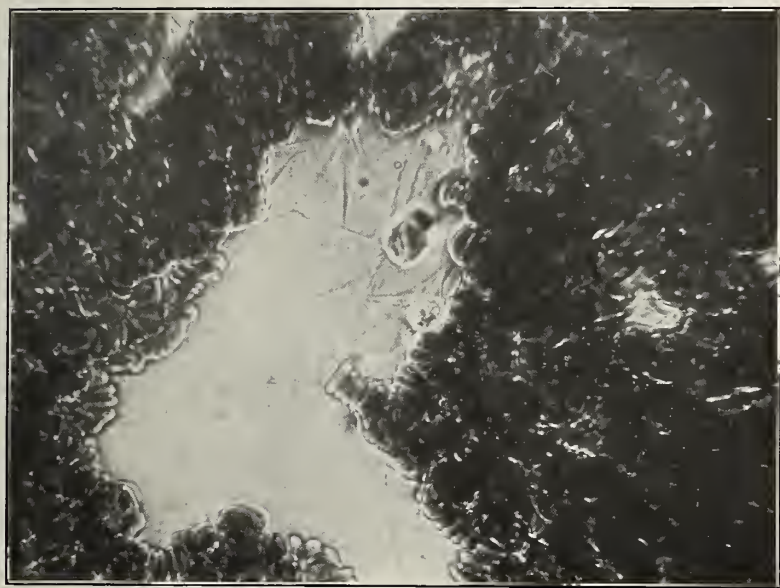


FIG. 42.—1-9 obj. and 3 ocul. Rheumatic fibrin.



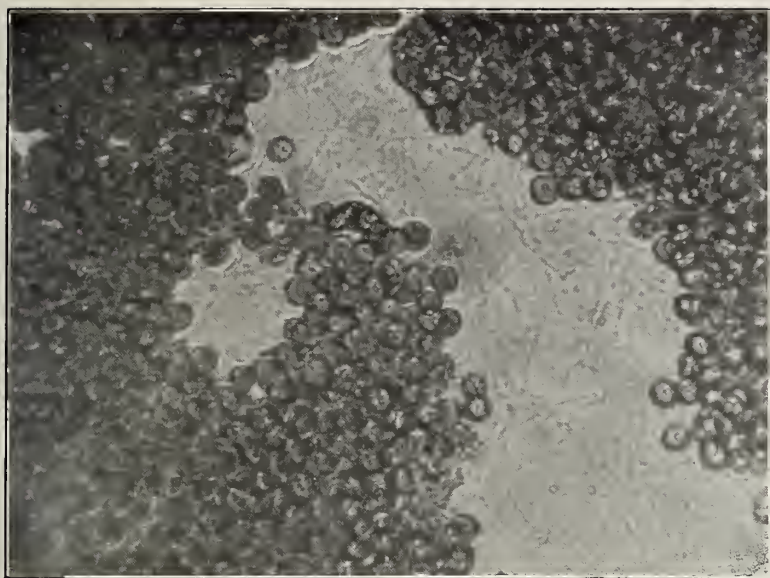


FIG. 43.—1-12 obj. and low eye piece. Rheumatic fibrin somewhat broken.



FIG. 44.—1-12 obj. Rheumatic fibrin in the serum.





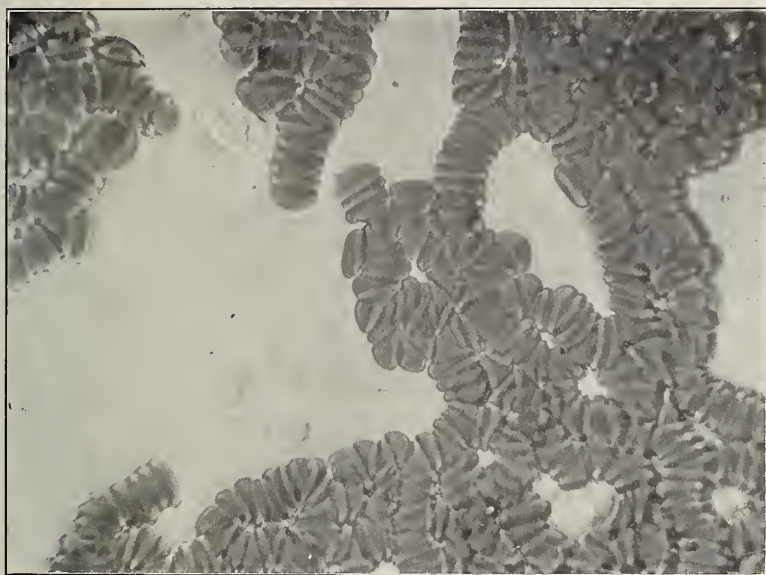


FIG. 45.—Case I. Fibrin 1-25 Tolles obj.

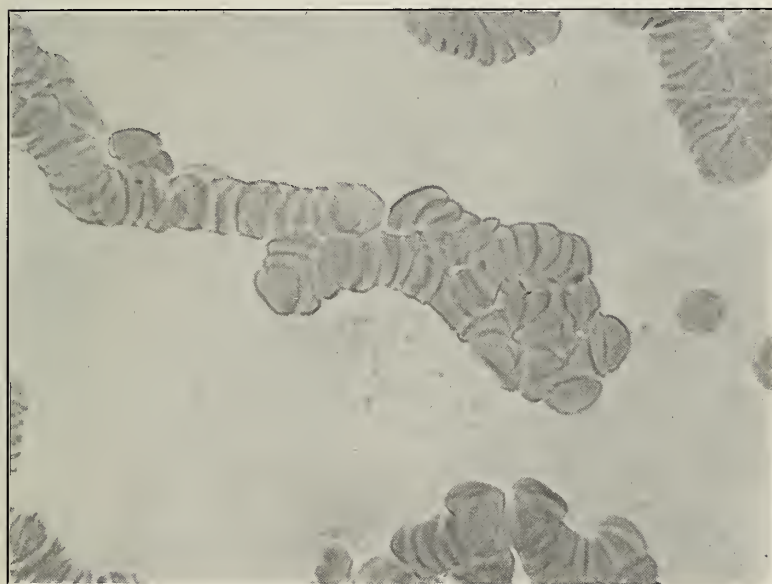


FIG. 46.—Case I. Fibrin 1-25 Tolles obj.



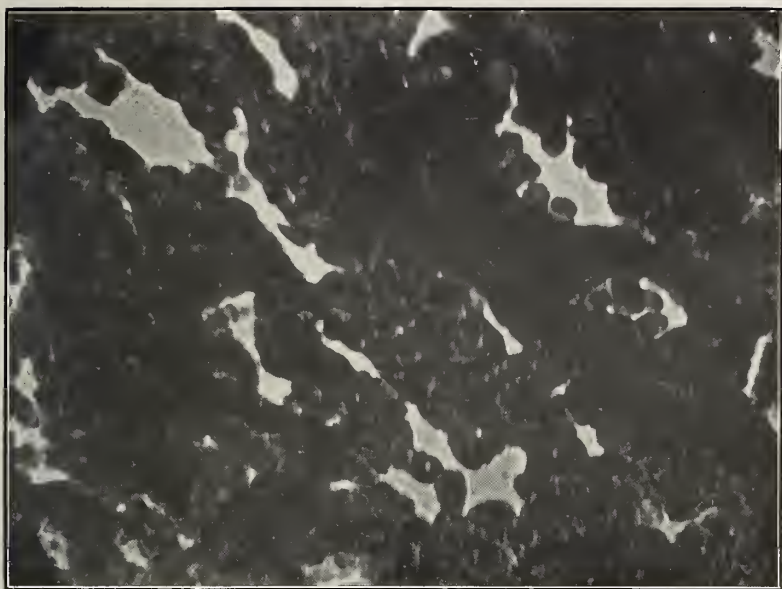


FIG. 47.—Rheumatic arrangement of the red cells at the height of the disease. Very adhesive. For description see page 150.

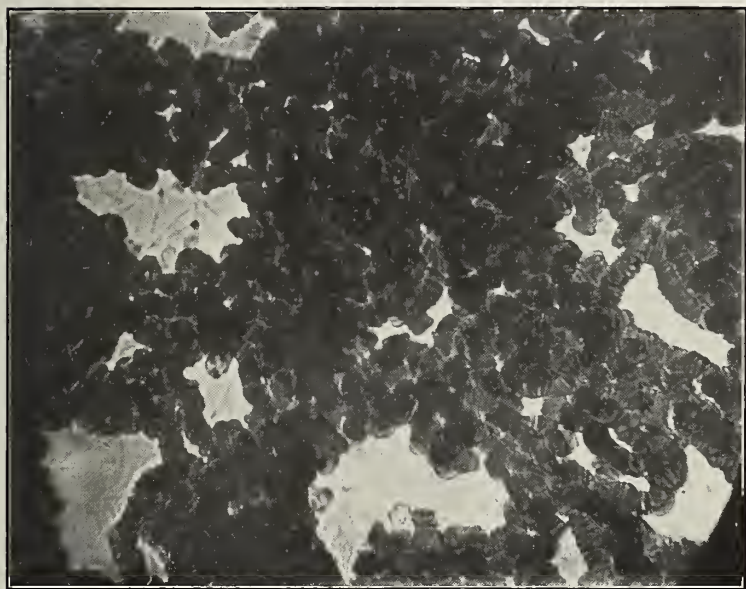


FIG. 48.—Same as Fig. 47, improved condition of the patient. Less adhesiveness of the cells. For description see page 150.



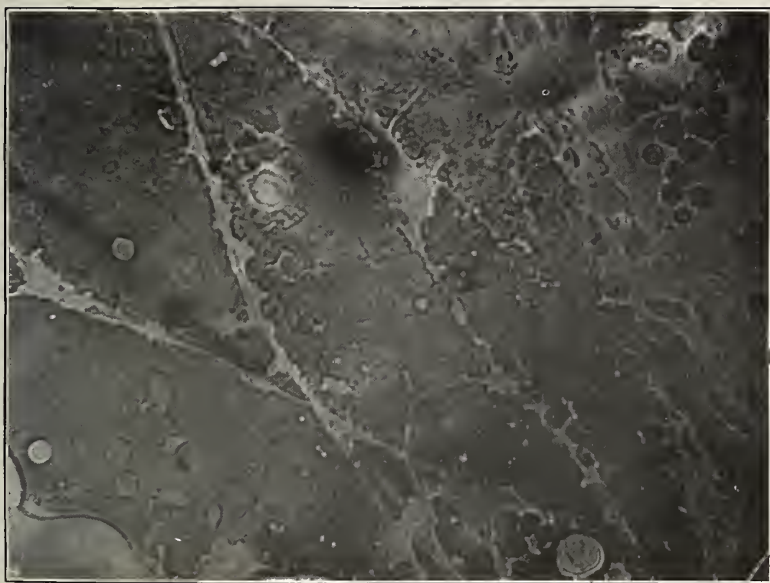


FIG. 49.—1-12 obj., Case II. Fibrin skeins after standing some hours.

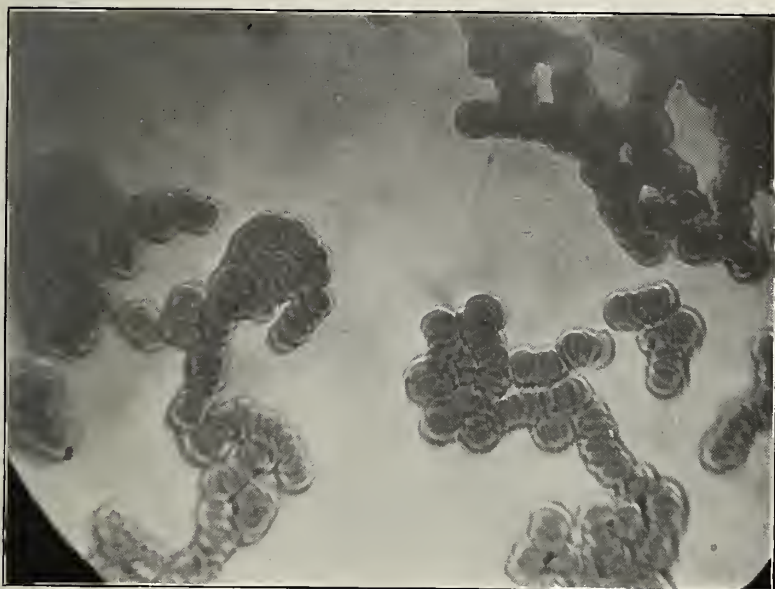


FIG. 49½.—Fibrin in the blood. Spores of syphilis very distinct in the white blood cell.





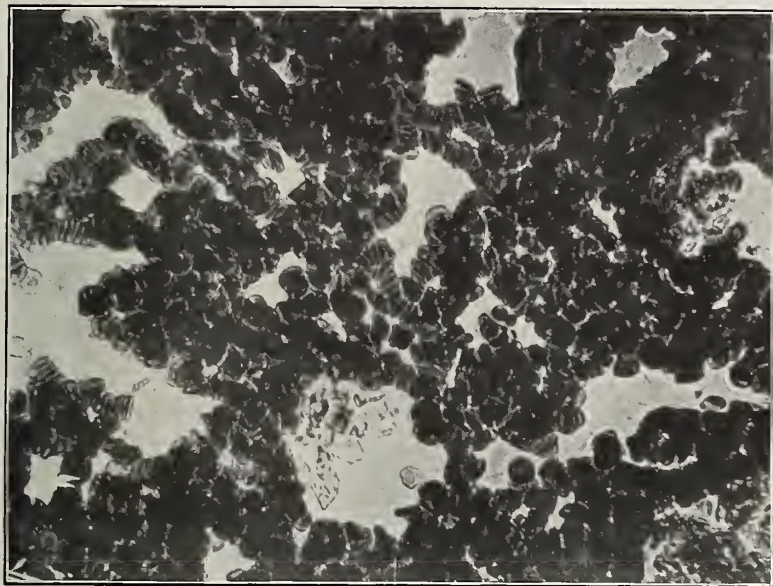


FIG. 50.—1-6 obj., 4 ocul. Cystine crystals—Sadie Martinot.

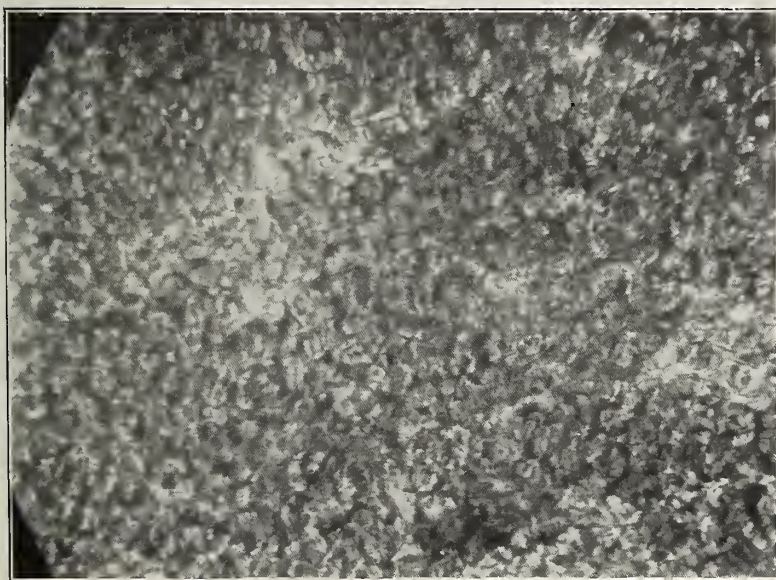


FIG. 51.—Max O'Rell.



**CRYSTALS IN THE BLOOD.**



Crystals in the blood have been so little known that it was thought best to illustrate with many photo-micrographs. It will thus impress the physician with the reality of such in the blood.



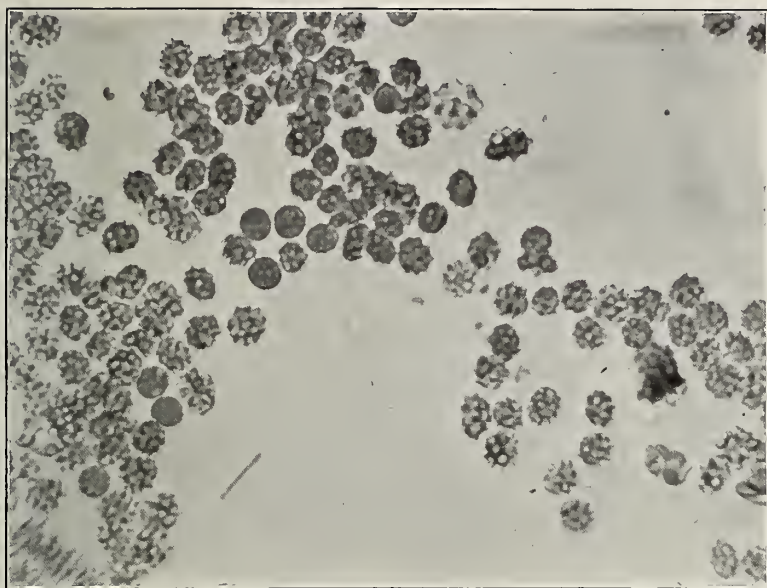


FIG. 52.—12 obj. Crenated red cells and a probable crystal of cholesteroline.

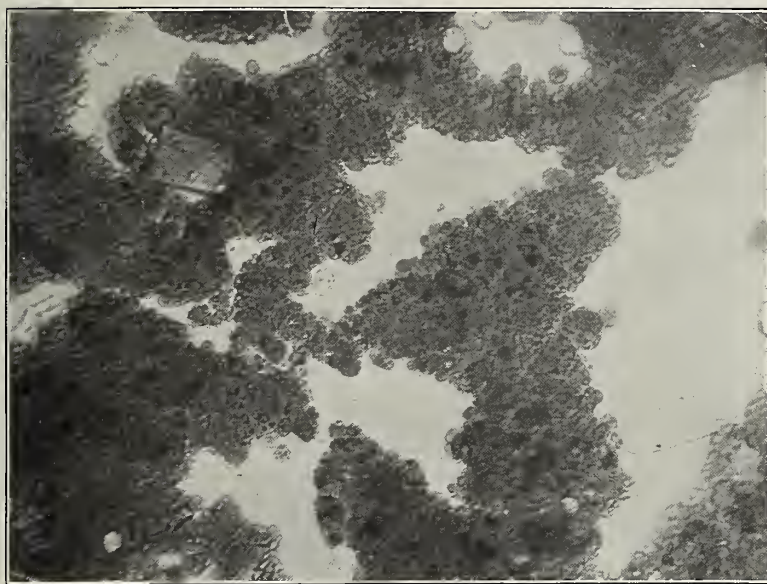


FIG. 53.—Crystals of triple phosphates in fresh rheumatic blood.





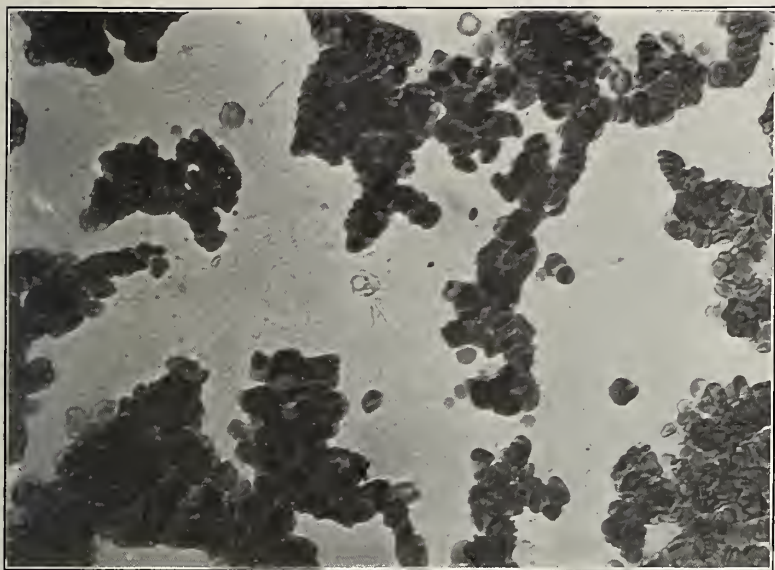


FIG. 54.—There are two needle crystals here—the centre—just below a leucocyte or vacuole. It is hippuric acid.

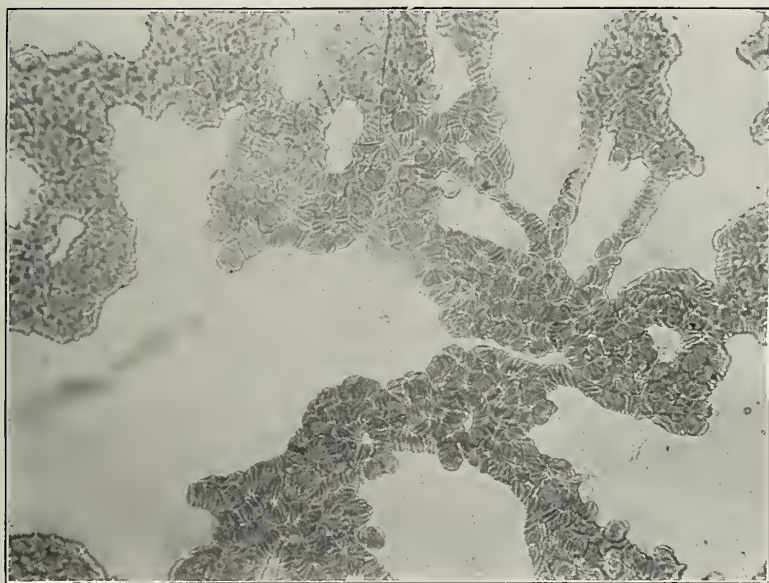


FIG. 55.—Triangular crystal at the top. May have come from the skin.



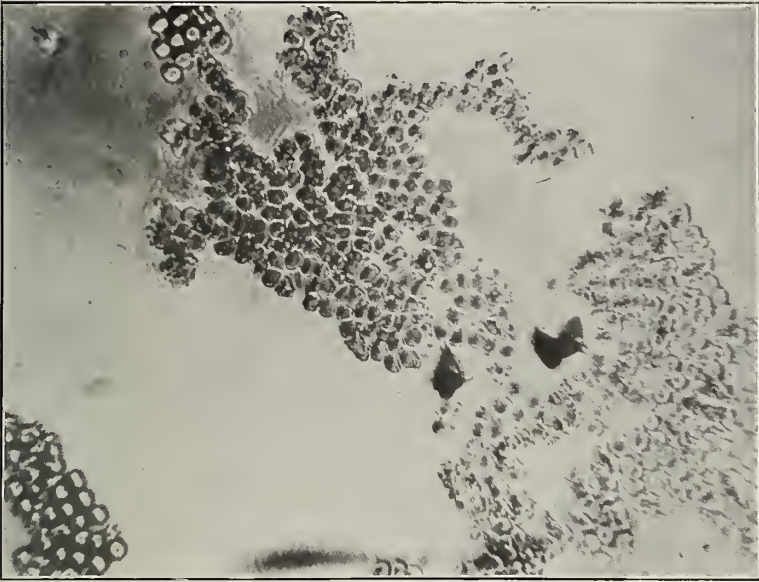


FIG. 56.—Uric acid crystals, after the blood has stood on the slide some hours. The red cells have contracted considerably.



FIG. 57.—1-12 obj. Large uric acid crystals. They are somewhat distorted, which is due to the lens.



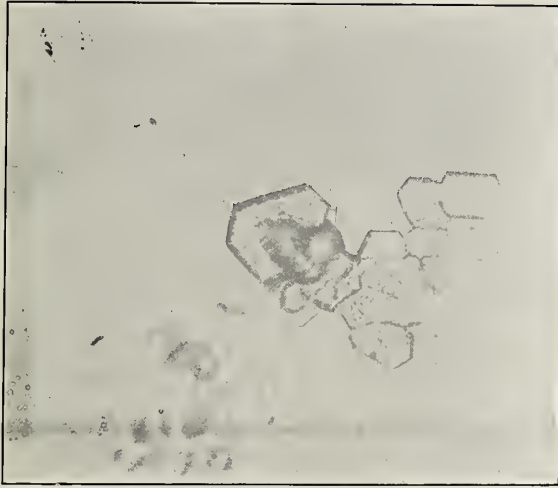


FIG. 58.—Cystin crystals in urine.

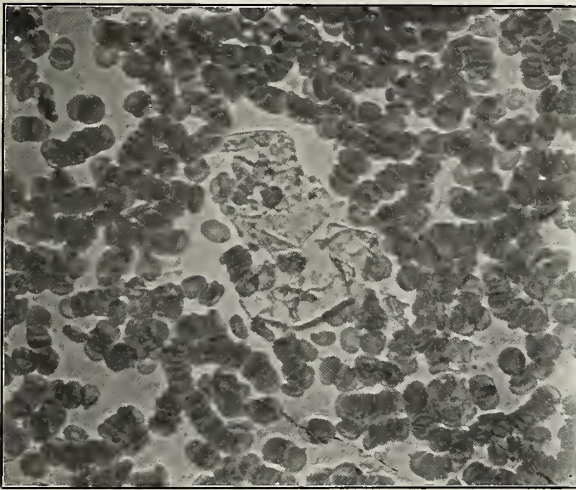


FIG. 59.—1.9 obj. Cystin crystals in the blood. Taken from case of cystinic rheumatism. These crystals are very readily seen but more often not as perfect; generally they look like broken glass. They are very hard and insoluble and are often the cause of brain lesions in rheumatics.





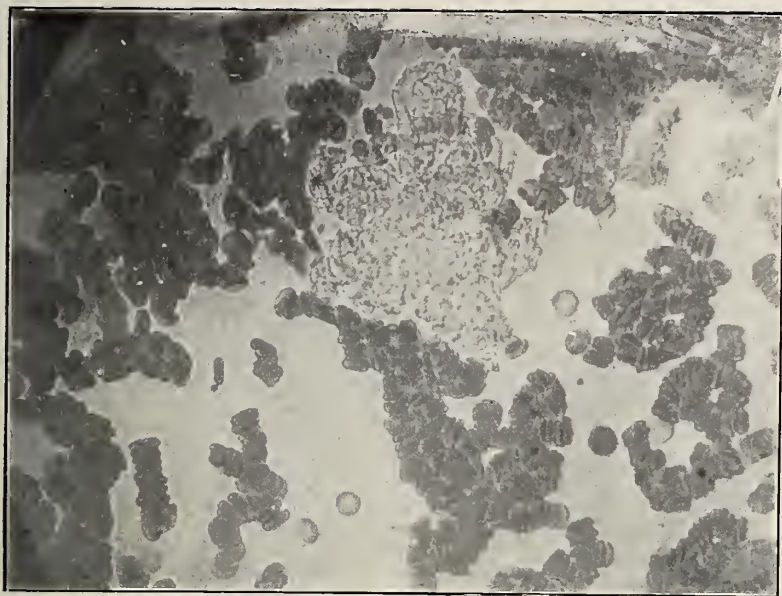


FIG. 60.—Broken glass crystals of cystin.

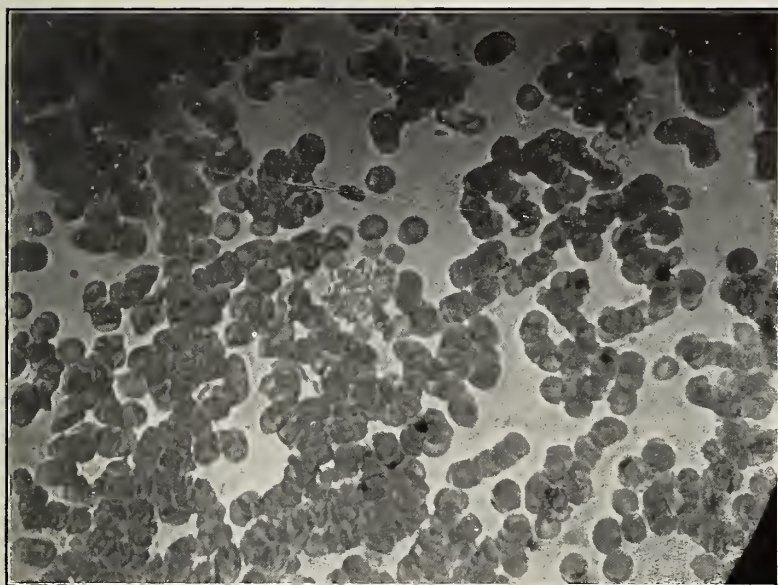


FIG. 61.—A very uncommon form of uric acid crystals in the centre of the field.



# EMBOLUS.

(CLOTS.)



Under this heading (of embolus) are included cardiac disease, apoplexy and paralysis.



## EMBOLISM AND ITS FACTORS.

It is important that this chapter follow the preceding, for not only is this coagulation of blood in the system the precursor of most paralyses and apoplexies, but it is preceded by one at least of the various kinds of rheumatism. These rheumatic conditions may, therefore, be considered from a blood standpoint as first cousins to heart disease and those diseases mentioned on preceding pages.

Many and long articles on the cause and composition of clots in the human economy could not only be written here, but quotations of the analyses of thrombi could be made from Virchow and other like authorities of equal rank, but of more recent date. All text-books contain similar analyses, for these emboli (clots) have been found postmortem for years. Therefore, all are agreed as to their composition. It is only of late that any of these constituents have been recognized in the living blood; they have been seen, but not recognized, and there is a great difference between the two words. I once knew a plumber who undertook a job all others had failed to do. When the work was completed his bill was \$50 for half an hour's work; this being disputed, he itemized it thus: Five dollars for the work, and forty-five for knowing how (recognizing). It was then promptly paid, for the debtor readily saw the difference between the man who recognized the trouble and the one who merely saw the pipes. I shall quote briefly what has been seen, and leave the constituents of these clots—the knowledge of which is common property—to be recognized in the photographs.

The writer has tried to impress upon the mind of the reader that in all cases here considered he has invariably been present at the bedside of the patient.

At the French Congress of Internal Medicine, held at Nancy, August 6-10, 1896, Professor Mayet said:\* “Cases are met among chlorotic subjects in which thrombosis (clots) is due to a *primary lesion of the blood*, and accessorially to a disturbance in nutrition of the wall of the vessel. The reasons of this are manifold in chlorosis. In fact, the blood is *richer in fibrin*, as

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\* See Bibliography.



the researches of Becquerel and Rodier and Andral have shown. Hayem's views to the contrary, notwithstanding." This is a disease in which there is generally an excess of leucocytes, as well as a diminution of haemoglobin. A photograph on another page will show the fibrin as it is being formed from the leucocyte (Fig. 93). From this same article many similar opinions might be quoted as to the cause of these clots, but we are dealing only with the fact that they can be seen in a drop of the living blood. In the same article, Dr. H. Vaquez says:

"Some investigators have shown, on the other hand, that injections of various substances facilitate coagulation of the blood, whereas others retard it, for a longer or shorter period." His article further says:

\*"Jones, followed by Zahn, showed that the clot was formed not by successive deposits of fibrin, but by accumulation and conglutination of the leucocytes. The role of leucocytes in the phenomena of intravascular coagulation is, therefore, a very important one. Examined at its beginning, the thrombus is found to be formed by an accumulation of leucocytes surrounded by a fibrous substance, which is first loose, but gradually becomes firmer. In the midst of this light tissue of fibrin, one finds at points where the fibrinous meshes meet, granulations (rosettes of Ranvier). There are few red corpuscles, which subsequently increase in numbers. The latter appear to be of slight importance, but it is otherwise with the fibrin. Ranvier's granules are small masses of fibrin, probably pre-existing in the blood, and becoming centres of coagulation in the same manner as a sodium crystal put into a solution of the same salt becomes the starting point of crystallization. Hayem has described these bodies as hematoblasts, whereas Bizzozero, Eberth and Schimmelbusch have adopted the term blood plates. They are seen and described already in 1845 by Donne under the name of globulins. It appears to be admitted by all hands that they exist before the formation of the thrombus, because Hayem, Bizzozero and others have found Ranvier granules in the blood in circulation."

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\* See Bibliography.

These facts have been determined by examining the clot after death. That this primary lesion is "of the blood," that the blood is "richer in fibrin," that it is formed by "accumulation and conglutination of leucocytes, the "granules of Ranvier," and, he might as well say, various crystals. These ingredients, we repeat, have all been found by examining the clots after death. *And these parts of a clot, embolus, thrombus, infarction have been known for many years, and it never occurred to these men to look in a drop of blood taken from a living subject to see these very same things. They are all there, and it only remains for me to point them out in the photo-micrographs which follow.*

The white blood cell forms the fibrin—that is one of its functions—one performing this function is shown in Fig. 93. And so, of course, there would be many in the clot spoken of previously by Dr. Vaquez. The granules of Ranvier are the tuberculous granules or the tuberculous matter in a small quantity which is described under the head of tuberculosis in this work. A photograph of a mass entangled in a long fibrin skein is shown in Fig. 68. It was taken from the system of a living man. This fibrin skein circulates through the blood as a comet courses through the solar system. If the man does not improve in health it grows and finally lodges in some vessel which it plugs and shuts off the circulation in that part. In this case, it stopped in the brain of a man in the night, and he never woke to know what killed him. The fibrin which in these conditions forms in long skeins in the blood vessel has been there long before the clot that produces the disastrous result is formed. This fibrin skein in the blood of the living man grows in length and thickness day by day and year by year. It entangles crystals, tuberculous granules, fatty leucocytes, and whatever foreign matter may be in the vascular system. This in time produces vegetations on the valves of the heart (traveling clots), and the various conditions mentioned above are produced, which so often in the past have rendered necessary a necropsy in order to find out the cause of death. In the case mentioned, the man never had rheumatism

of the joints. He was never sick very much, but as a rule in such cases the subjects suffer from vertigo, ringing in the ears, and slight stomach trouble as precursors.

These things are shown in the photographs following. Portions of them, and often the whole of a small clot can be seen with a microscope in a drop of blood in the living man.

Dr. Vaquez is quoted as saying that there are solutions which render the blood either thick or thin. Many have noticed this. Magendie, who lectured in the College of France in 1839, knew this, and he thus speaks of one Ruysch, who had discovered and used a fluid, which he injected into the circulating system of his patients, and which was perfectly mixable with the blood, Magendie says in regard to him:

\*“I cannot allow the opportunity to pass without expressing my disapprobation of the narrow-minded selfishness evinced by the anatomist just named in carrying his secret with him to the grave, after he had turned it to the best pecuniary account during life. The loss is one much to be regretted. Who knows but that, had we been acquainted with the composition of the fluid he employed, we might have under various circumstances been enabled to modify the blood beneficially for our patients, to restore it some of the properties it might have lost, or given it new ones.”

Magendie speaks of the viscidty of the blood and of the various injections that modify it. It may be that this solution which Ruysch was using was for the purpose of modifying these clots. Magendie does not say so, but he seems to imply it, for he himself experimented with various solutions that modify the consistency of the blood.

### CASE I.

The oblong rope-like mass of cells shown in this photograph (Fig. 62) is an embolus, or clot, from a child 10 years old, who had rheumatism of the heart. The attack began in the joints and went to the heart in a very short time, producing death. This clot was in the drop taken ten hours before collapse oc-

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\*See Bibliography.

curred. You will be able to make out the red and white cells entwined and bound together by the fibrin skeins. It has long been known and is recorded in most modern text-books that such clots are found at the autopsy (see Green's Pathology, p. 55). With such photographs as are shown here and on succeeding pages it is useless to say that these can just as well be seen before death. It has always seemed strange to me that so few records have been made of the fact before, for this certainly is a symptom of the symptom."

This child suffered severe pain before she died. My brother, who saw the patient, said the case was complicated with pericarditis. I applied various reagents to this clot under the microscope. A salt solution was tried first with no effect. A strong potash solution was then tried on another specimen. This dissolved everything in sight. Among other solutions of no avail *tr. digitalis* was tried, solution of strychnine 1-50 gr. in a hypodermic syringe of water, dilute solution of muriatic acid, the vegetable acetic acid and also others. All caused no change of any moment. I finally added a solution of sodium chlorid and sodium bicarbonate, and the cells in this cut separated from each other and let the skeins of fibrin to themselves. This fibrin I noticed was also somewhat diminished in size, i. e., the skeins were partially dissolved by the use of the sodium bicarbonate alone. I would produce the photographs then taken with the 1-7 Leitz obj., if the fibrin skeins were not so fine that a half-tone would not show them to good advantage.

With such facts, is it any wonder that the alkaline treatment is of benefit in these cases? In Sir Benjamin Ward Richardson's work, "*Vita Medica*,"\* which gives the result of some of his experiences and observations in a practice of 50 years, he alludes to the treatment of emboli which lodged in the right heart of several of his patients, and its removal with doses of strong ammonia. His method was to give the ammonia in milk—I have forgotten the dose, but I know he gave large quantities of it. I recollect that he was called to a

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\* See Bibliography.



woman with a fibrous embolus in the right heart. He said he gave "milk and ammonia until she smelt of it." He relates several cases and under this treatment they all recovered. The book is well worth reading, and may suggest something in the remedial line of life-saving value. It was the alkali separating the cells from and partially dissolving the fibrin that saved his patients.

## CASE II.

The next case illustrates the embolic fibrin separated from the cells as occurring in a patient with rheumatism complicated with heart disease. Fig. 63. When seen among the blood cells the fibrin reminds one of a comet in the heavens floating amongst the nebulous stars. The patient was very much crippled with rheumatism when first seen, but she made a good recovery.

## PARALYSIS.

### CASE III.

Mrs. D., 75 years old, was suddenly attacked with vertigo at the dinner table in July, 1896. I attended her until her physician, Dr. Daniel M. Stimson, arrived. An examination of the blood revealed the long skein of fibrin seen on the opposite page, thus showing that she had emboli (clots) floating in her system. One year later she died suddenly of heart disease. This is another illustration given to show that these fibrin skeins are an accompaniment of cardiac lesions. Fig. 64.

I remember another woman over 80, who had exactly the same symptoms as the one above, only more severe and of longer duration. (No picture is shown.) The former was affected the first time only a day or two while the latter was in bed several weeks. Dr. George Van Schaick was the family physician, and will remember her, for the doctor thinks the woman's age is nearer a hundred than eighty.

The examination of the blood revealed none of those skeins; in fact, the fibrin was normal. She made a good recovery, and is living to-day (and this was two years ago). The trouble in this case was in the stomach.

## COW'S BLOOD.

## CASE IV.

Here is also shown the pictures of an embolus (clot) in a cow's blood. The blood of a cow looks like that of a human being, the cell, however, being a little smaller. Figs. 65-66.

This photograph was obtained during my vacation one summer from a cow on a stock farm. Two years after I met the overseer of this farm and inquired about this cow, for records of her history were kept for some time. Several photographs had been taken. He said that one day this cow turned around in its stall a few times, as if dizzy, and then dropped dead.

## CASE V.

Rare, indeed, is it to obtain specimens of blood with the fibrin network intact. No stain has yet been found to prove even its existence, so elastic and so changeable are its fibres when exposed to the light. But as we were going to press a patient came in with a rare form of paralysis, the main symptom of which was inability to control his head. He had to hold it forward by placing his hand on his jaw. He was a most pitiable sight, for he was only 24 years old, tall and handsome. If he let go, his head fell back and his face assumed a horizontal position. It was a tiresome position, and he was rapidly becoming very weak. He had not been out before for two months. He was sent to me for examination by his physician.

The first drop of blood taken is reproduced here. Fig. 67. The thickened fibrin network of the blood is shown as it actually existed in his system. In its normal condition, this lattice work is smaller and the lines finer than in this specimen, and it reminds one of a fisherman's net floating on the surface of the water. So this fibrin network floats in the blood, and the corpuscles occasionally pass through the meshes back and forth as this cylindrical net is lazily suspended in the plasma of this colored river of the system.

As is already perceived, this fibrin is a normal ingredient, aye, one of the factors of the blood. It is really a tissue, an organ, which has a function to perform, and that function is interfered with when these filaments become thickened, and bile, salts or other crystals entangle themselves in its delicate tissue. A great deal of pathology to-day can be explained by giving this fibrin its proper pathologic importance.

So, in this man's blood we have what looks like a cast of the fibrin. In reality, it is an infarction which has clogged up a vessel and produces his paralysis. It is a microscopic thrombus, and is associated with rheumatic blood. He had been told that his trouble was due to syphilis; on being informed that this disease was not in his system, his reply showed his appreciation, since he said that fact alone paid him for coming from a distant city.

The treatment of this case should be on the same principle as that of an embolus, for this is a similar condition, only slower in producing its effects. Sir Benjamin Richardson's plan, i. e., the use of alkalies, ought to work well here, together with massage and electricity properly applied.



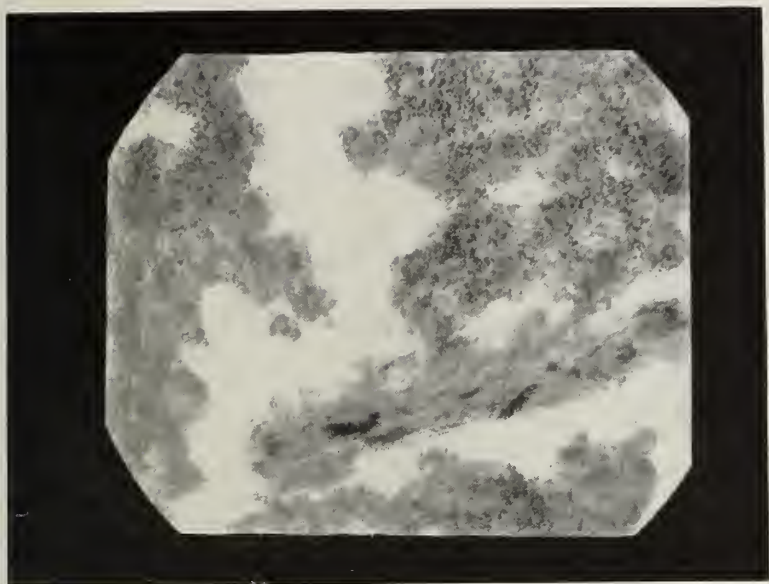
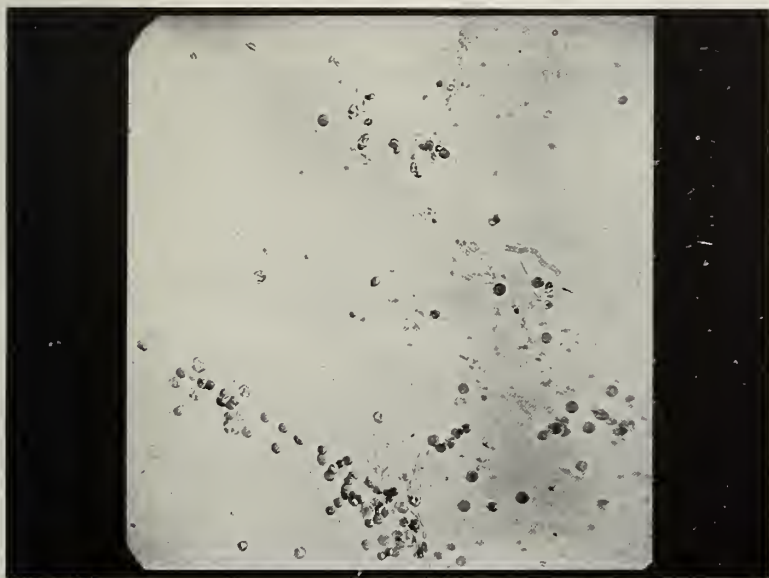


FIG. 62.—Rope-like appearance of the embolus (clot) is easily seen, the black spots show where the cells are matted together in spots.



Embolic fibrin.

The engraver, as we go to press, finally succeeded in reproducing this photograph. The fibrin skeins are readily seen separated from the cells with the alkaline solution. See page 187. Same specimen as Fig. 62.



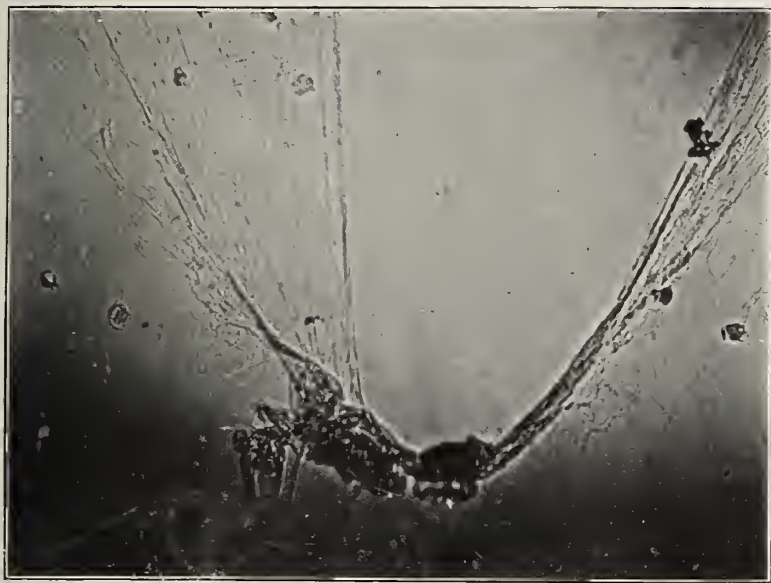
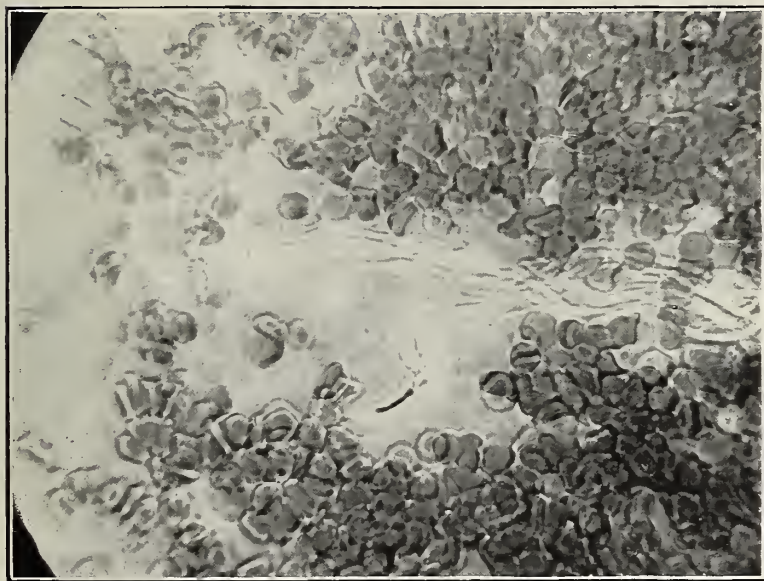


FIG. 63.—Embohc fibrin with the corpuscles washed away with water.



1-12 obj. Fibrin in a case of heart disease.



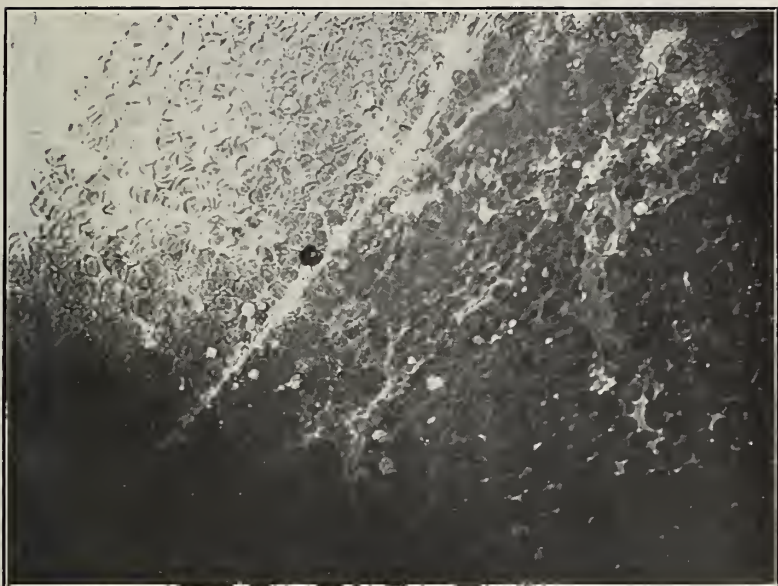
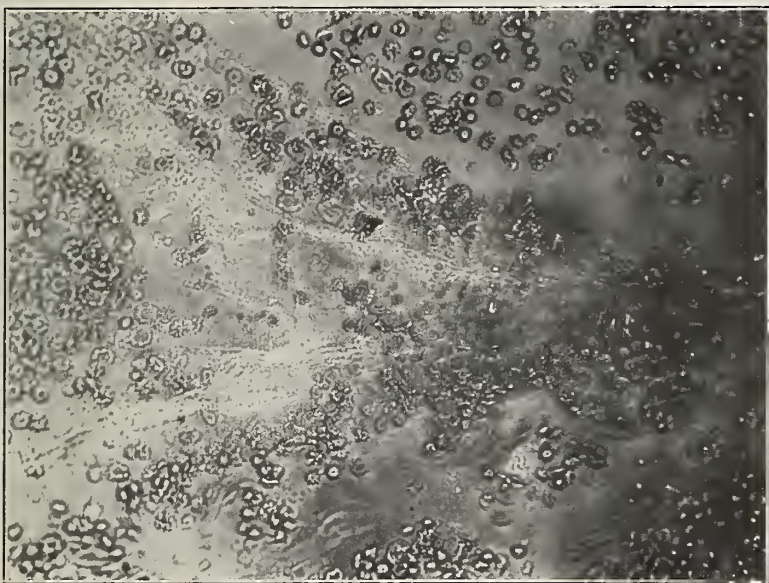


FIG. 64.—Fibrin skein between the corpuscles.



Fibrin skeins found in the blood of a patient five years before death. Four weeks before death gangrene of the lower extremities had set in, and at the autopsy this was found to be due to large emboli (fibrin skeins), occluding the iliac arteries. Autopsy was performed by Dr. F. Baker, of Worcester, Mass.





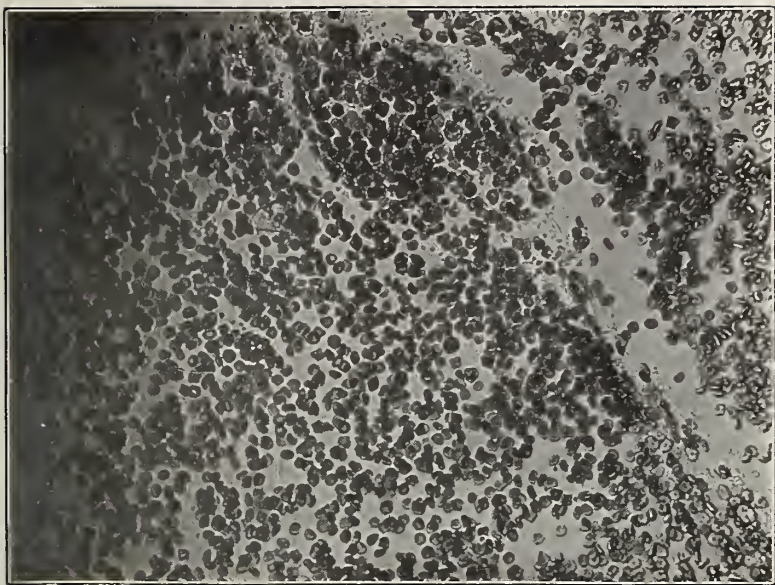


FIG. 65.—Cow's blood.

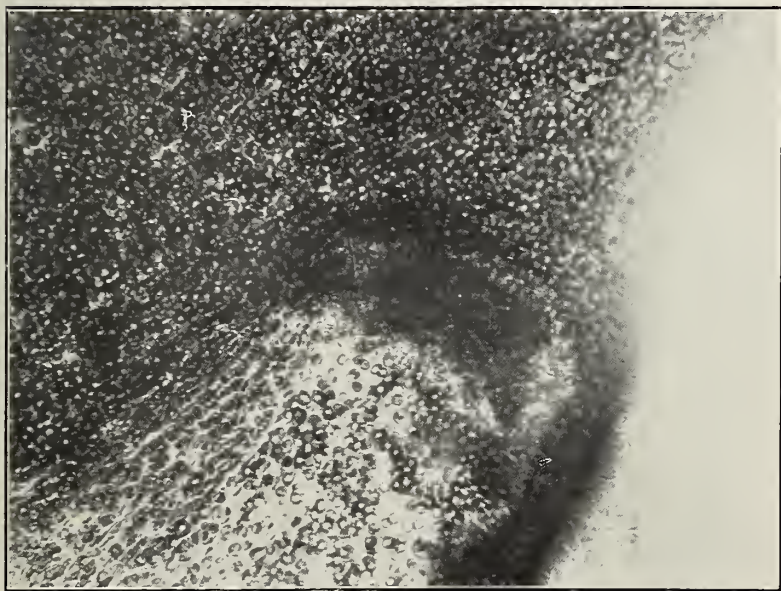


FIG. 66.—Cow's blood—apoplexy.





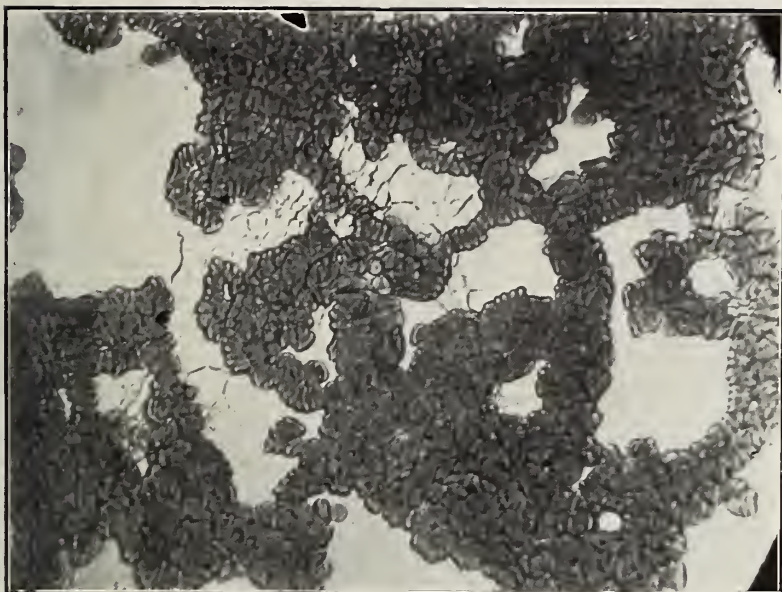


FIG. 67.—Network of fibrin.

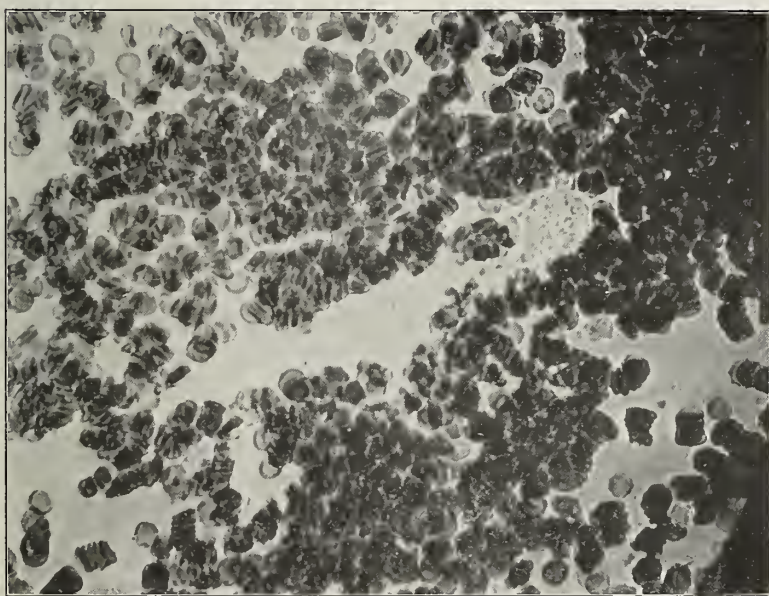


FIG. 68.—Embolus formed of tubercular matter and fibrin.



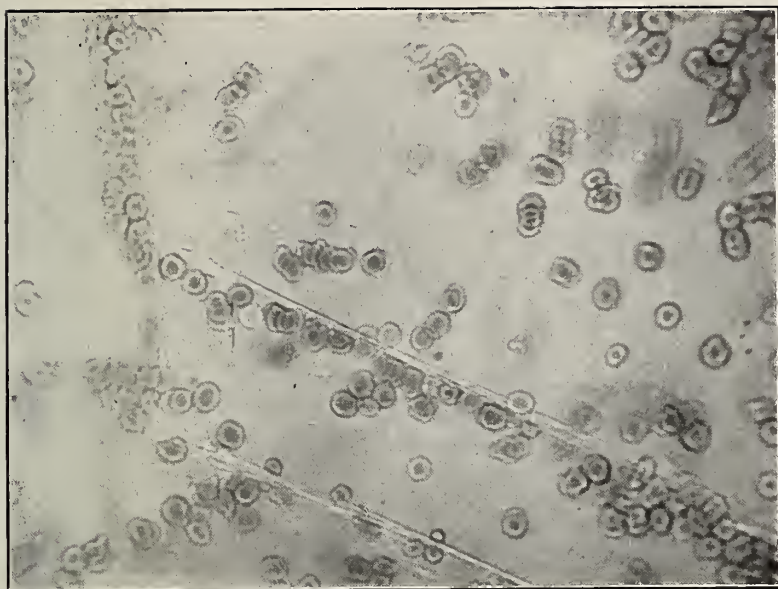
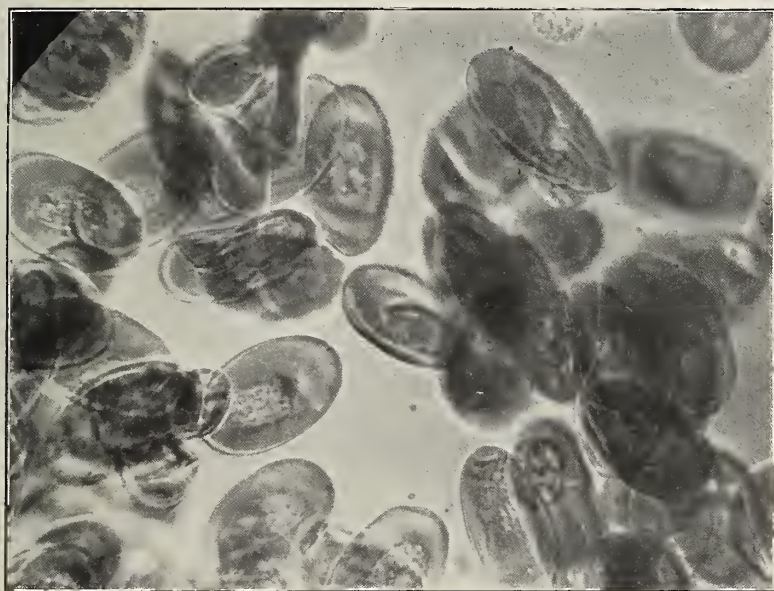


FIG. 69.—Emboli in the blood. Bellevue Hospital case (1894).  
(No text.)



Lizard's blood, 1-12 obj. The nucleus of the red cell in the lizard becomes in time the white blood cell; in man it is the reverse.



# CARDIAC DISEASE.





## HEART DISEASE—RECOVERY.

### CASE I.

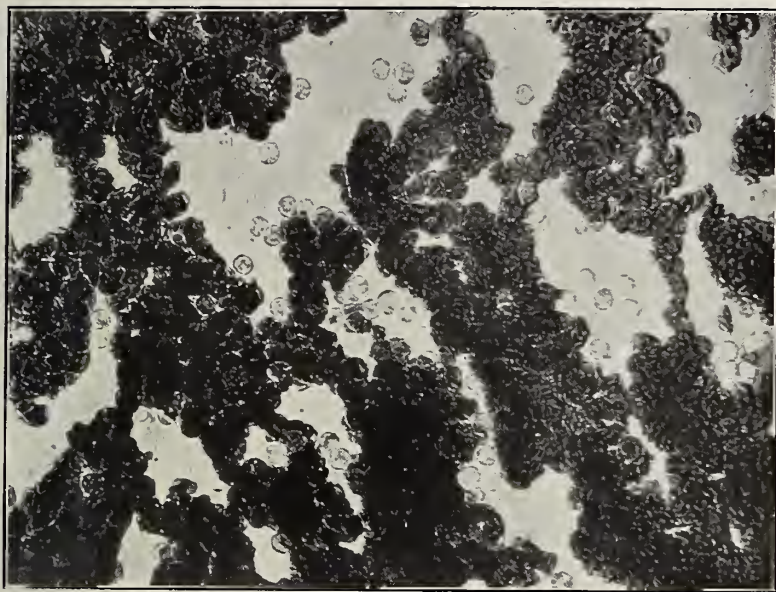
The accompanying photographs are taken of the blood of a girl 11 years old, who was taken suddenly with shortness of breath, pain over the heart, and fever, and became so weak that confinement to her bed was the only thing possible. It was no doubt a case of endocarditis with rheumatism. The pain and fever came suddenly, and there was a distinct murmur over the left heart, a mitral regurgitation. This got worse for some days. Dr. George E. Doty saw the case with me, and treated her a few days while I went to the country. See Figs. 69, 70, 71, 72.

You will note the ropy red cells and the large number of white corpuscles, together with the long fibrin in some spots. An ulcerative process was evidently in progress. After three weeks she began to get better, and to-day is practically well. She is now 16 years of age. There is no cardiac lesion perceptible. The photograph (Fig. 73) was taken recently, and shows the return to a more healthy condition of the blood, as well as of the individual. She is now the picture of health. This was a plain case of heart disease with recovery.

### CASE II.

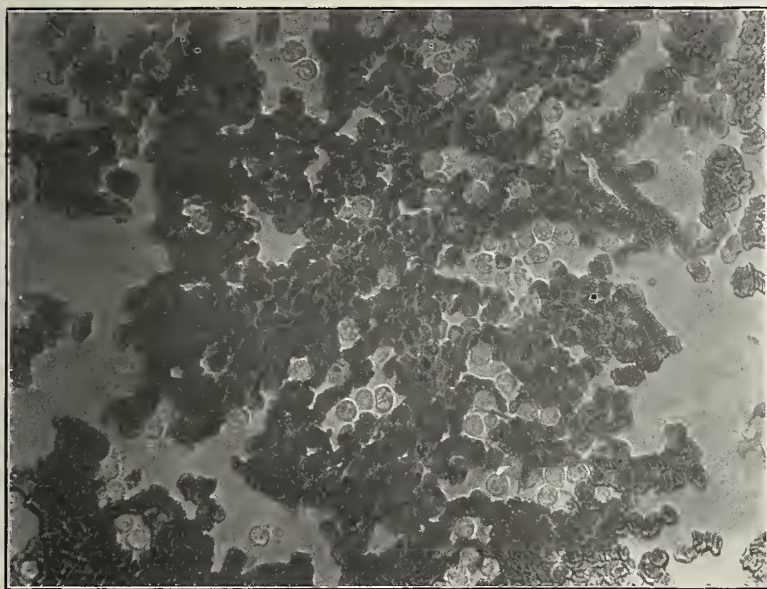
This last figure, 74, represents the blood of a banker, 28 years old, of very healthy appearance. The valvular sounds were very loud and audible all over the front of the chest and in the back. The fibrin skein here is very distinct. This is a good illustration of the fact that a young man can be apparently well and strong with a grave disorder, the lesion of which may be recognizable both by the blood and the usual physical signs. Often the blood of such persons contains crystals, and again fat globules within a swollen white blood cell. When these deposit in the heart year after year and a little at a time, after they have existed there for years, they are called vegetations. These sometimes break off and go to *distant parts and cause paralysis*. It is thought by some that they are only on the valves of the heart, but I am glad to point out that they are also in the blood stream, as here and elsewhere stated.





Case I, page 205.

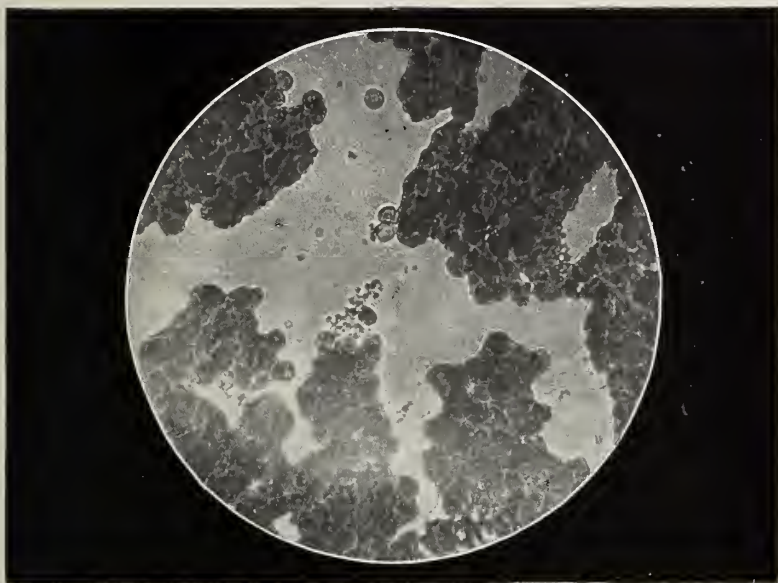
FIG. 70.—Note the leucocytes, the character of the fibrin and the clumping of the red cells.



Case I, page 205.

FIG. 71.—Another view of the leucocytosis.





Case I, page 205.

FIG. 72.—1-6 obj. Showing the tubercular matter that is often present in these lesions.



Case I, page 205.

FIG. 72½.—1-12 obj. Same as Fig. 72.





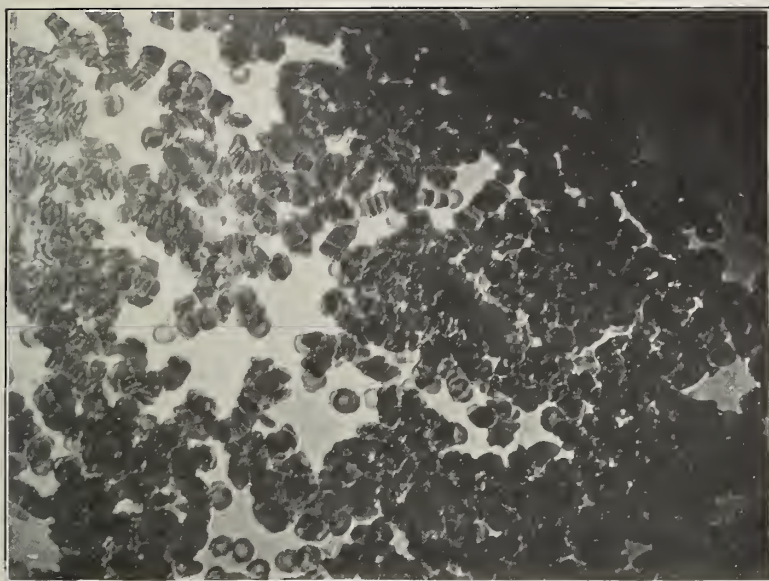


FIG. 73. Same as Figs. 70, 71 and 72, after several years—recovery.

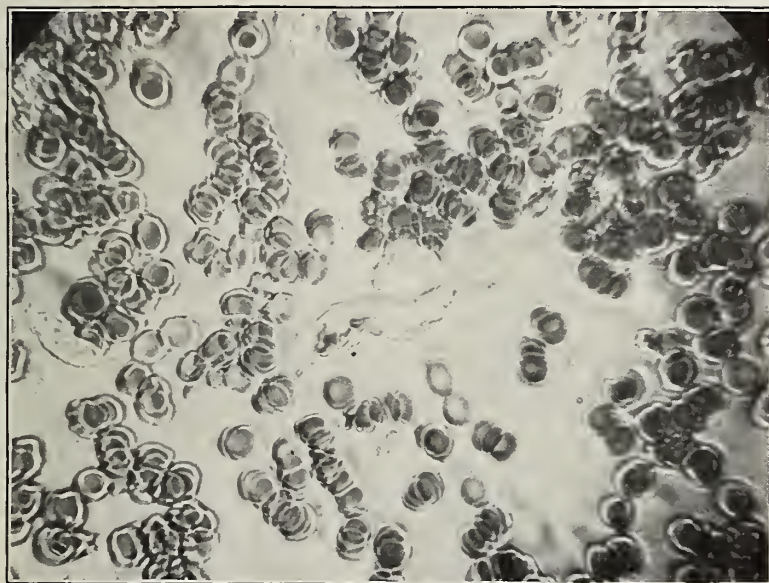


FIG. 74.—Fibrin. Case II. See page 205.





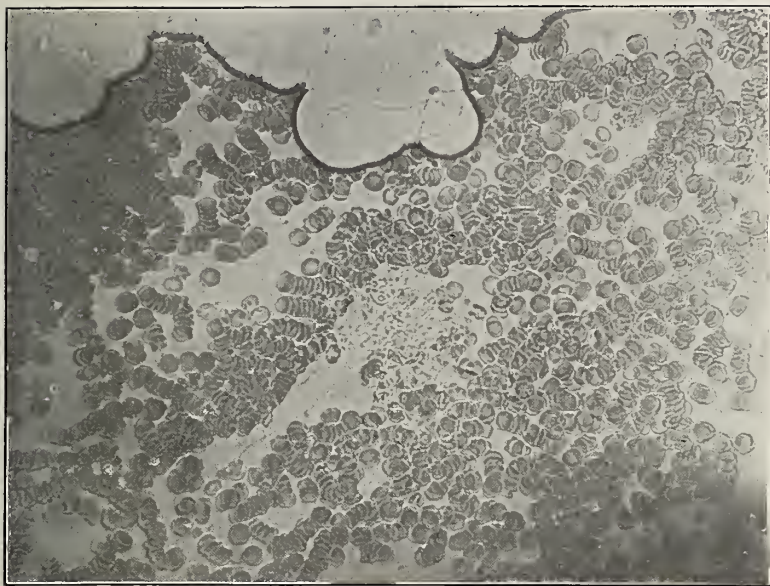


FIG. 75.—Long skein of fibrin, crystals and foreign matter, could easily form an embolus.  
(No text.)

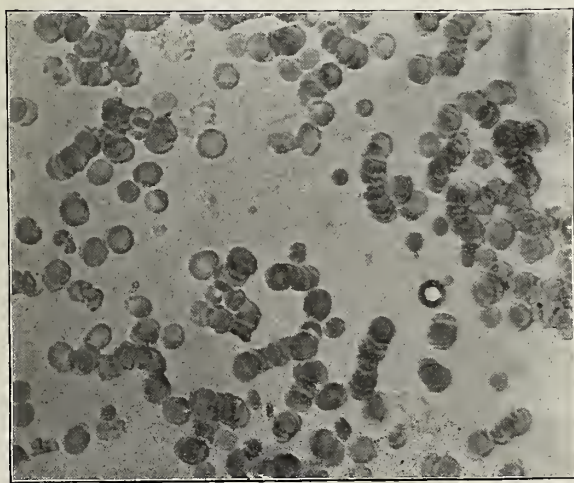


FIG. 76.—Blood of old lady who died of a lingering paralysis. Fibrin plainly seen.



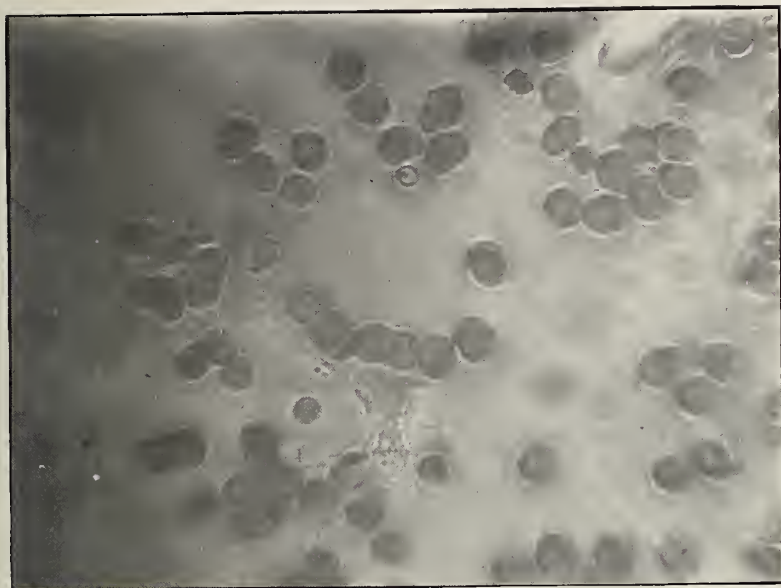


FIG. 77.—Fibrin factor of embolus in a Santiago soldier. He had a valvular lesion. Was laid up with Santiago fever at the time picture was taken.

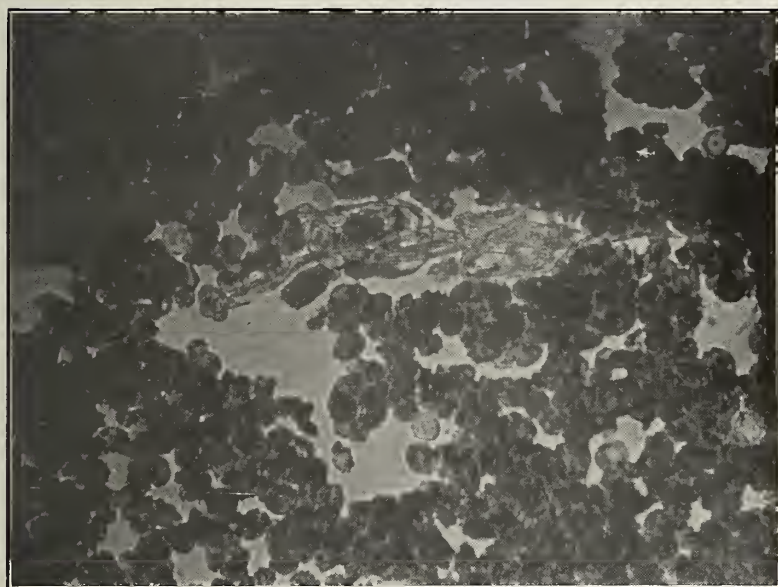


FIG. 78.—Case examined for Dr. F. E. Miller (no text). Mitral regurgitation and aortic stenosis, showing the fibrin skeins.



# MENINGITIS.





The two cases here considered were taken in the alcoholic ward of Bellevue Hospital by permission of Dr. Chas. L. Dana.



## MENINGITIS.

I do not know that this specimen of blood is characteristic of alcoholism, but it was taken from a patient in the alcoholic wards of Bellevue Hospital. The man said that he had been drunk every Saturday night since he was 15 years old.

It will be seen here that the corpuscles are all broken up, and it is a fact they are rotten, for they are apparently filled with little holes and there was scarcely any color in the cells. This, as usual, was a fresh specimen. (The streak in the lower border of Fig. 79, is a tear in the film of the negative.) Such patients we all know are often taken off with pneumonia, but this man (Fig. 79) died of tuberculous meningitis. I say tuberculous, for there is tuberculous matter visible in the photographs (Figs. 79 and 80). They were taken under the service of Dr. Chas. L. Dana.

It will be seen from these two photographs, as was pointed out under unhealthy blood, that it is not requisite for the blood to be agglomerated or adhesive in order to be unhealthy.

It will be noticed that while the blood cells are evenly distributed in the first photograph, in the second this is not true. From what has been learned in previous pages, it will, therefore, be seen that from the blood standpoint, the man from whom the second picture was taken suffered from some form of rheumatism, but this is not true in the first case.

It is well to call attention once more to the fact that several fields of the specimen should be examined in order to get an average of the general appearance of the blood.

It will be noticed also, in Fig. 80, that the fibrin is very prettily shown. It can be seen that, naturally, the fibrin here is long and thick, but actually it is broken in spots, thus showing that, if not his constitution, something is shattered.



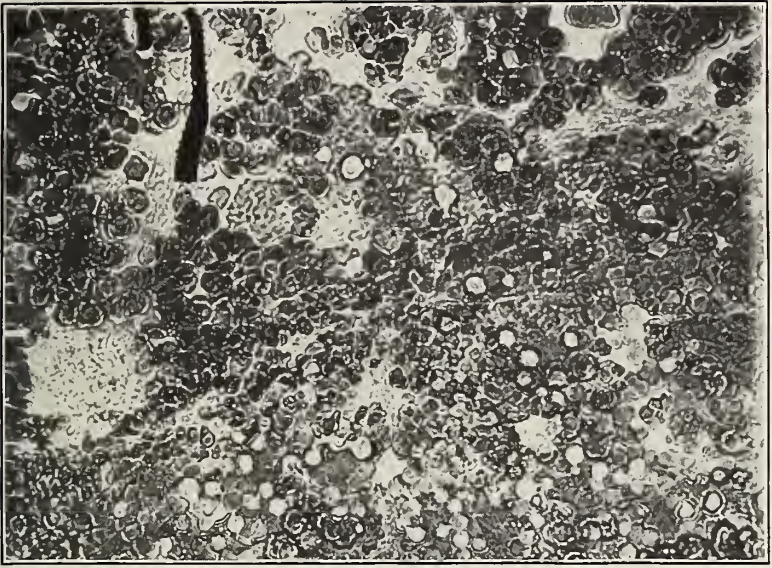


FIG. 79.—Meningitis—alcoholic.

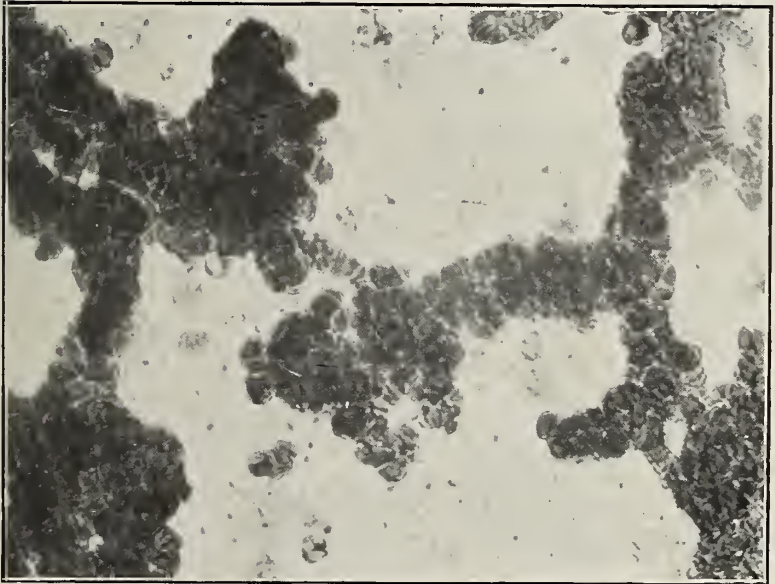


FIG. 80.—Meningitis.



# McKINLEY'S CASE.





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## THE EXAMINATION OF THE BLOOD IN PRESIDENT MCKINLEY'S CASE.

By the death of President McKinley, on September 14th last, the nation has lost a man whose inner life was little understood or appreciated by the vast majority, even of those who respected him and thought that he never erred.

While it may seem strange to many that his name should be mentioned in a work of this kind, on reconsidering, it will be remembered that the consulting physicians submitted his blood to a microscopic examination.

At the time of Garfield's assassination, the examination of blood was not much thought of. In the past few years, however, this line of work has made great strides; and blood examination to-day is carried on systematically in every large hospital.

The question naturally arises: What could have been indicated by the blood in the President's case that would in any way have been of value?

Theoretically, everything should be told, while practically a blood examination is of more service than would be imagined by those who are not familiar with this line of work.

The statement made in another part of this work is applicable here, that when one part of the body is "sick" the whole suffers with it. An experienced diagnostician, by means of the blood alone, can often tell when parts of the body are "sick." The condition may be recent, or it may have been coming on for years.

I say the blood will often tell the inner story; as the old quotation says: "Every action of our lives touches on some chord that will vibrate in eternity."

So, to a greater or less degree, every action makes some change in the body. There may be no practical way of determining the finer effects; but if a definite action of mind or

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body is kept up, in time the change is perceptible to the eye. And so, for health or disease, this change takes place, and sometimes it is years in showing evidence. This evidence today can be seen by one experienced in blood diagnosis. For example, gangrene will show changes in the blood, and the physicians resorted to a blood examination in the President's case.

Both a fresh and a dry blood examination should always be made if everything is expected to be found that is determinable by this diagnostic method.

William McKinley, like all public men, was cartooned, criticised and misrepresented for years, even by many who now see their mistake. All men who have a conscience are aware that much criticism on a sensitive man is not only wearing, but when joined with the great weight that falls on our Chief Executive, from such sources, would rip the very nervous tissue—say nothing of the nervous energy—in a man of McKinley's sensitive parts.

And such changes can be seen in a fresh or living blood examination. The poikilocytes and the microcytes, either one or both together, might be present in the blood. When such changes take place in the nerve elements, the blood corpuscles have not their proper form; they should all be round and elastic, but instead they are elongated, angular and flabby, and often the number of dwarf cells are increased because the system does not have time to manufacture strong, full-sized cells.

The nervous energy is used up too fast, and this latter condition is especially perceptible to the diagnostician when the crenated red cells are abundant. These cells can be seen easily in the fresh blood, and that there be no mistake as to what is meant by fresh or living blood, we refer the reader to the introduction. Of course, if the blood stands half an hour or so, all the cells get more or less crenated. But they should be

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seen floating around in the serum as soon as the drop is placed on the slide see Fig. 93. That then indicates the condition of the system. Fig. 81 illustrates it well.

These things that have been pointed out are seldom thought of by the majority of blood examiners. More often, an increase in the number of white cells is what is looked for. Normally, there is one to about every four hundred red ones; but, as a rule, these are counted by the *dry method* of examination\*. One examination by this latter method is often of no avail. In the President's case there were found, according to the physicians' report, 6,752 white and 3,920,000 to the cubic millimetre of the red cells, which is below normal. In each it was expected that there would be an increase in these white cells, or more than normal. The only way for the dry method to be of any definite value would be by reference to a previous examination.

If the President six months before, or even a month before, had had his blood cells counted, a comparison of that condition with the one at the time of his sickness would have been of some value one way or another. There will be a time when people will have their blood examined as regularly as they go, or ought to go, to their dentist. If a photograph is taken, there is a definite record to look back to.

Therefore, as it happened, the blood examination of the President threw no light on the case.

The fresh blood examination, however, in the hands of a diagnostician—and every physician should be his own—should have at least revealed his weak condition—this lack of vitality.

In President Garfield's case, if blood examinations had then been in vogue, it would have told much, but not without a previous record (or a photograph) to compare. It was found at

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\* Normally by this method there are 7,000 white and 5,000,000 red cells to the c.m.m.

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the autopsy that he had an abscess\* cavity, which had nothing to do with the wound caused by the bullet. This, in itself, would show leucocytosis, or increase in the white cells.

The pyemia, which afterward developed in Garfield's case, from the destruction of tissue, would have shown marked increase in the white blood cells, and probably much tubercular matter.

This statement on McKinley's case from a blood standpoint is simply to show some things that all do not think of, and to indicate what often can be told from a fresh blood examination, in contradistinction to the dry.

It is not in any sense intended as a criticism.

According to the report of the physicians, the President died directly as a result of the gunshot wound.

When the nervous energy in a man is exhausted, the result is just as bad as though his blood vessels were empty. The preservation of the vitality in the human economy is to-day not appreciated by the majority of men and women. This energy can leak from its channels in the body in many ways, the same as steam can leak from the boiler or cylinder of the steam engine. If you shoot a boiler full of holes there will be no steam left to make the engine go; and so McKinley was shot, and his already weak vital system was drained still more (of energy).

The fact that the bullet affected the pneumogastric-nerve and, perhaps, passed close to the solar plexus, is what did the damage. This, in itself, often kills. Pugilists are aware of this, and use a belt to guard this location. Attention enough is not given in our post-mortem examinations to the nervous tissues that are affected by shocks, due to either wounds or surgical operations. For when the nervous energy is low, or there is a great loss of blood, which is often dangerous; poikilo-

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\* See Bibliography.

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cytes or flabby red cells are often present in proportion to the weakness, and these cells would always be of great aid in diagnosing this condition.

The shock in this case dissipated what nervous force the President had left, by shutting off one of the main channels through which this energy travels in going from the head to the feet. This shock can be compared to the breaking or short-circuiting of the main wire of a dynamo-electric machine under full load. The result here would be the stopping of the machine. In the body, the only thing that could happen would be death of tissue, mortification or death of the man as a direct result of the shock. Again, often in connection with the nervous shock, the dwarf cells make their appearance in the blood and we have nerve weakness, indicated especially when these dwarf cells are mixed with the poikilocytes. In order to see these latter well, a large drop of blood must be had and the cover glass must be laid on gently, for the ability to perceive and judge this condition cannot be gained in a night; it cannot be learned in the laboratory; but the ability to see these peculiar red cells slowly floating about in the watery portion of the blood can only be learned at the bedside of the patient.

When these two kinds of cells described are present in abundance, the blood supply is distributed slowly to any part because the heart action is weak. Death of tissue in this state of the system must result somewhere. When gangrene sets in, even in a moderate degree, there will generally be found an increase in the white blood cells. Germs of various kinds, *then* begin their work; if present, bacillus coli communis and gas germs, in connection with the others, call for more fuel; the continual lowering of the vitality *allows* the fuel to be supplied; and so the germs multiply and gangrene goes on.

President McKinley's death was due primarily to the gunshot wound, and, secondarily, to the low state of his nervous energy.

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There have been only a few recoveries from similar wounds—such is never expected. Dr. Van Hoevenberg\* reported since McKinley's death one such in a man aged 33. The young man was strong and vigorous, his vitality or nervous energy was high; he withstood the operation well, but possibly the ball did not strike in as vital a part as in the case of McKinley. Still, it is generally considered that bowel wounds, such as that reported by Dr. Van Hoevenberg, are the more dangerous.

Still more plainly does this lack of vitality stamp its fatal mark when it is remembered that the President's whole body began to mortify in a very few days. This, again, will confirm the opinion that there was lack of vitality, due to the wound, and the long strain under which McKinley had been laboring.

To some it will appear out of place, nevertheless medical periodicals throughout the country have been eulogizing President McKinley more or less. We therefore say, without fear of controversy, that William McKinley was one of the few modern public men that had lived and *knew how to die*.

He probably, for the time, saved the life of the man who slew him. "Be easy with him, boys."

Plutarch says, when speaking of the personality of Phocion, the great Greek general: "That a word or a gesture from a truly good man carries more weight than ten thousand eloquently argued speeches."

And so in the President's last hours upon earth—just as natural as though he were going to live for twenty years to come—McKinley (as James G. Blaine said of Lincoln in his debates) said: "The things that would stand the test of time and square themselves with eternal justice," more truly and more as he lived, than any public man of whom we have record in modern days.

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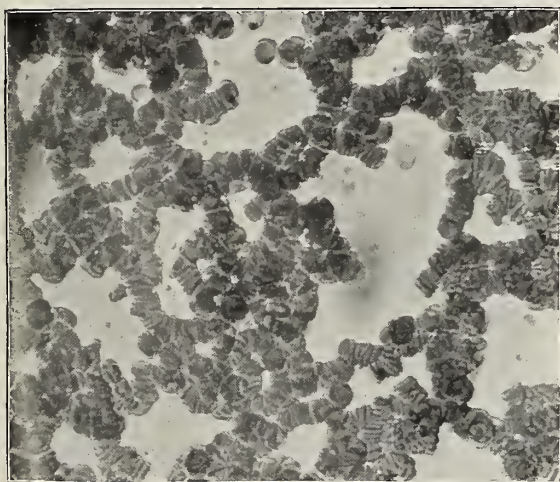
\* See Bibliography.

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FIG. 81.



Thick blood.—No text.



# SYPHILIS

(THE CRYPTA SYPHILITICA.)



In considering the subject of syphilis, the history of it has not been gone into to the extent that I should have liked. Neither has it been dealt with in the preamble in the customary way of approaching the description of a germ, but it has been dealt with in a way that would best suit the time.



## PREAMBLE.

It was about 1860 that Pasteur began to investigate germs as a cause of disease, but the idea of living organisms—minute forms in active motion—being the essential cause of syphilis—as according to Alhanasins Kircher (1659) they were of the pest—was advanced as early as the seventeenth century.\*

Syphilis is a very ancient disease.\* It was known to the Chinese over 2,000 years ago, and in Italy during the war between France and that country it is stated the disease was so contagious that it was taken by the slightest touch or even through the air. It came to America on the same ship that brought her discoverer, Columbus. In the fifteenth century it was epidemic in and about Italy;\* indeed some claimed that it was infectious and that it could be taken both by contact and through the air, and hence it was considered contagious as well as infectious. In the next hundred years its virulence very much decreased, and to-day authorities affirm that it is only contracted by contact with a mucous surface either by an abrasion of the skin, or is transferred by inheritance “to the third and fourth generation.”

The above facts seem to prove that the disease becomes less and less virulent from generation to generation with the higher development of mankind. Education or evolution some day will at this rate do away with what was once considered a most contagious and awful disease.

There is no doubt that the disease in some persons and in some localities is more virulent than in other persons and in other localities. It is said that this disease, when contracted by our soldiers in the late war in Cuba and in the Philippines, resisted treatment most obstinately. This may have been due to lack of nourishment and lack of strength. This disease to-day is, in some cases, known to be self-eliminating.

In about 1870, physicians began to look into the subject of

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\* See Bibliography.



germs in earnest and some have gone so far to-day as to claim that every disease has its germ. This idea has spread so fast that the diphtheria of the present day is not the same disease of a few years ago. Since the discovery of the Klebs-Loeffer bacillus, in connection with diphtheria, according to the bacteriologists, the physicians have a finer method of diagnosing that disease. By this germ the disease is recognized in its incipency while the old "putrid sore throat" of our forefathers is still diphtheria in its severest form. A mild tonsillitis is to-day considered diphtheretic if the Klebs-Loeffer bacillus is found to develop on the culture media which has been planted with the above inflammatory product.

Diphtheria therefore is to-day more common because a method has been found for discovering it in its incipency.

Syphilis will also become apparently more common when the general practitioner and the medical profession have had the germ distinctly pointed out and when it is fully understood by them as well as by those who have made it a study because a finer diagnosis can then be made. It will then be seen in its travels from generation to generation, for in these cases its symptoms are often so mild that they are overlooked, and there are often no external symptoms whatever; the worst visual symptoms being sometimes the copper-colored eruption of the skin.

In fact by its very symptoms to-day syphilis is considered by the best authors as a non-venereal\* disease. This is due in a great measure to its being found by specialists to complicate many affections and thus it is traced by skin symptoms to be more common than formerly, and this opinion is confirmed by the quick response of the disease to treatment.

And lastly, it is found to be contracted in so many different ways—from segars, instruments, kissing, closets, surgical operations, manufactories, etc. These things, together with the fact that age lessens the virulency of a disease, have tended to make this one more common. And syphilis being a chronic disease and of longer duration than an acute dis-

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\* See Bibliography.

order (like diphtheria), has longer to remain latent and thus longer to become attenuated in the system.

Syphilis, then, by the germ method of diagnosis is apparently more prevalent than formerly, because it is detected first in its incipency and second in its inherited conditions and third in its latent state.

Pasteur demonstrated that the inoculation of an animal and the re-inoculation of man with the same disease (hydrophobia) made the disease less virulent. Darwin says that "Man is liable to receive from the lower animals and to communicate to them certain diseases, such as hydrophobia, variola, the glanders, syphilis, cholera, herpes, etc." These facts again contribute to the decrease in the virulency of the disease.

Leprosy, in Biblical times, was a much more severe disease than it is to-day. In chemistry at the present time it has been found that former supposed elementary bodies are composed of several elements—the latest report being that hydrogen is a compound body. And so applying this principle to medicine, it may be that syphilis is an off-shoot of leprosy.

The destruction of its tissue is similar and much of its pathology is like that of syphilis.

Again, the spore of the bacillus stage of the syphilitic germ, as described in this book, resembles the bacillus of leprosy both in looks and size as it is described by others. As to other tests for the similarity of the two, I leave them to the bacteriologists. These facts may indicate that the syphilis of to-day is cousin at least of leprosy.

There is no doubt that there is a food in the system on which this germ of syphilis lives which is becoming gradually eliminated. This food we have not yet recognized, but the germ I think we have.

Most of the recent literature on dry blood examinations has dealt on the subject of syphilis from the standpoint of cells. These writers seem to persist in the notion that syphilis produces some form of change in the red or white blood cells. Others seem to think that they will find that syphilis produces changes that influence the number of red or white cells.

While I would not discourage this kind of an investigation, I would not expect to find changes of this character, except in the advanced stages of the disease. Lostofer had this notion more than one hundred and fifty years ago, and the fact of his researches is recorded in "Ziemmsen's Practice of Medicine."

The germ of this disease, however, was discovered many years ago, and I shall proceed to describe it, for it is easy to see when the blood is freshly drawn.

## THE GERM OF SYPHILIS.

The germ or plant that is found in this disease consists of three parts or stages of development. First, the spore. This is round and its diameter is about the diameter of the tubercle bacillus. It is of a dull red color and very lively for such a small object. It thus needs a one-twelfth objective, and unless one is accustomed to looking through the microscope, it may be difficult for such at first to see it, but if once seen and it is looked for often enough and long enough, it will be recognized always and then it is unmistakable.

The spore is sometimes found in the red corpuscle, more often in the white, but mostly in the plasma of the blood. It is immobile occasionally in the red corpuscle—here in this state it is often mistaken for other things—it is here also in its mobile condition that several are sometimes found together swimming about, reminding one of a swarm of bees. In the former condition, they have been mistaken for the plasmodium of Laveran, the accepted germ of malarial fever.

In the white corpuscle also they are quite active—as much as the cell wall and their crowding together will permit. I show photographs of these small spores in a white corpuscle. Figs. 82-83.

In the serum they jump about in the most wonderful manner; they have a jostling, irregular, spiral motion; but when many are present in the serum, they remind one in their motion of a lot of small flies as they swim on the surface of a mill pond.

The second stage of development, as it appears to be, is the bacillus of the same color and about three or four times the length of its diameter. It seems to have a glistening surface or membrane, as it refracts the light in its slower but sometimes active movements. This is generally found in the serum—I have never recognized it anywhere else. It is not seen in all syphilitics. This bacillus appears to be similar to the de-

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\* The syphilis spore is magnified over 5,000 times in a photo under the head of miscellaneous on the back of the book, Fig. 122. They are white, due to the high power, and are entangled in the fibrin.

scription of the bacillus of Lustgarten. It is to be regretted that there is no laboratory with facilities so that the identity of the two can be demonstrated.

The third stage of development of this germ appears to be the filament discovered and demonstrated by Golosz, formerly of Vienna, now of Paris, where I met him in 1895. It resembles the cladothrix and can be seen best in the photograph presented to the writer by Golosz, when he was working in Aubou's Clinic in the International Hospital, at Paris, and is here reproduced. His method of seeing it is by staining with methelyne blue, baking, etc.—a process too elaborate to describe here. It also can be seen without the stains, but it must be observed quickly as it does not keep. Golosz told the writer that the spore or bacillus was discovered by an American, but the name he did not mention. However, it appears to be the mycelium of the crypta syphilitica.\* I have been told that Hellier, of Jena, has demonstrated this spore, but after diligent search, failed to find anything he has written on the subject. However, it is this that I have described, have found and still find in all syphilitics.

Still, it may be said that I have seen two cases in which no form of the germ could be found; this must be extremely rare and I am inclined to think it was due to an oversight or to the treatment, as this latter would sometimes prevent observing it. Still further, I have traced this disease by this spore through three generations, beginning with the grandmother. The last in the chain was a young man, and he it may be well to record for the benefit of those who claim there can be no re-infection, contracted it in later life in the natural way and went through the various stages of chancre, eruption, etc. In this young man the bacillus or rod form of the germ was found at the time of re-infection.

The trouble with most all the workers on this germ has been that they try to stain, heat or manipulate it too much. It is with little pains easily followed and seen in a fresh blood examination and in its natural growth.

I have said that sometimes these little spores of syphilis are

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\* See Bibliography.



so numerous as to resemble small flies on the surface of a mill pond. Still again, one will see but one or two in the serum swimming about. After getting accustomed to their looks, they, in their solidity, remind one outside of the color of steel filings, so firm, solid and definite is their appearance.

It's very strange how one can, by a slight twist, get entirely off the track of the original follower of a thing or principle. It is not always intentional, but in the case of this germ I think it often has been. For example, to show how one can get entirely off the track in this work a friend and professor recently said in regard to the discussion at medical gatherings of a certain doctor: "I don't know what to make of him—he gets up and tells about finding cholesterine and yeast in the blood—why I defy anyone to find authority for such statements in any of my books," pointing to his library, "for I have all the works on that subject." The trouble here is the man was looking for authority instead of asking the doctor to show him what he saw. But my friend was not altogether at fault, for, to be frank, much of what has been written on the subject of fresh blood examination could be found to-day, but it is a mass of jumbled up literature; and this work, in a way, is intended to help at least unravel the tangle which has existed for many years. All the descriptions that I have seen in the past few years of any form of syphilis germ correspond as far as they go with some stage of the growth of the *crypta syphilitica*.

The latest description of a germ of syphilis of which I have seen record was given in a paper before the French Academy of Medicine by Drs. Justin de Lisle and Louis Jullien, and from the meagre descriptions that come to us, it would seem that this again is another imperfect description of this cryptogam—the *crypta syphilitica*.\* Several have described this germ in the "Journal of Haematology" for April, 1901. Sternberg\* also mentions it in the second edition of his work on bacteria. Hallier, of Jena, has seen and worked upon it. Many there are who have tried to claim this germ under a new

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\* See Bibliography.

name, but have failed. The spore of this germ is to-day observed and *practically used* by a great number of physicians whom I could mention, but who never refer to it outside of their own office. The Gonococcus of Neisser was described in 1868 by the same American genius who discovered this germ of syphilis and he called it the crypta gonorrhea, its proper scientific term. It has never been fully nor properly described since that date (1868) by any author.

We have all heard of the borers (xglophagan)—a parasite which bores through the bark of a tree into its very substance. So this germ is the only one that infects the human body that is known to penetrate every organ. In its severe form and without treatment in a fit subject, “this spore starts from the skin or mucous membrane, and slowly journeys to connective tissue, muscle, liver, lung, spleen, brain and bone, deeper and deeper until no organ of the body is exempt from its ravages. To repeat, there is no other known germ that has such a wide distribution—always traveling in a regular order—often halting for a while, but if unmolested its march is resumed. It is very rare indeed that tubercle shows such wide distribution in the body as this germ of syphilis.” How strange when it responds so easily to timely treatment.

Darwin says: “It is those who know little and not those who know much, who so positively assert that this or that problem will never be solved by science.” And so those who have not seen this spore I advise to look for it. It will be found in the old man, it will be found in the middle-aged and it will be found in the blood of the new-born infant.

To observe this germ one must be constantly changing the focus of the microscope.

If this spore is not due to syphilis, my doubting friend, what is it?

Until the author adopted the vitoscope to microscopic photography, it was impossible to photograph this germ so that it could begin to be made plain to the student. Still it could be photographed, as is done in Fig. 83, which shows these spores in the white blood corpuscles.



With the above machine called the micro-motoscope, (see last chapter), it is possible to throw perfect microscopic life on the screen. Such was done with this germ, but owing to the great expense it has not been done satisfactorily, notwithstanding it showed other microscopic life as clearly as one could wish.

It is to be regretted that there is no laboratory in which this subject can be investigated more fully. Partly for this reason an exhaustive article on this subject has not been written and, if those who have the proper facilities have not time to follow this up, we shall be very glad to elucidate the subject at length for their benefit at some future time.

### REMARKS.

In recently developing syphilitics, I have often noticed great numbers of these spores both in the serum and in the leucocytes of the blood. As the patient gets under treatment they will be gradually noticed to diminish and finally disappear altogether. I consider it important to examine the blood when there is suspicion of syphilitic infection. If the spore is found the patient should be immediately placed under treatment, which is to be continued until the germ has disappeared. The treatment should begin at once as soon as the germs are seen and there should be no waiting for the usual secondary symptoms.

The germ then being of the type and character described it will be axiomatic, from what has been said in a previous article in this book—that the only proof that this germ is the cause of syphilis is on the same principle which the medical profession accepted the plasmodium of Laveran, (the germ of malarial fever as being its cause), which is by its constant presence in people known to suffer from this disease.

Therefore, it falls in line to give illustrations of cases in which it has been found. The evidence is so conclusive, however, in all such cases, that it seems to the author that one out of many hundred in his practice will be amply sufficient.

Eight years ago a patient came to me saying that he had exposed himself to syphilis, and wanted to know if the sore he had was that of this disease. An examination of his blood revealed the syphilis germ. This, on being told to him, naturally kept him disturbed all that night.

Not being so confident in those days of my diagnostic ability, I suggested that he go to a specialist, Dr. A., who after a careful examination said it was not syphilis. He went to Dr. S., of Boston, who confirmed this opinion.

Below I copy a letter received from the gentleman two years ago to-day:

“Dear Doctor:—

“I hastily write concerning a very serious matter. I have a growth extending about half way down the side of my tongue, which Dr. R. says is tuberculous. Dr. M., of —— Medical College, made a microscopic examination of a section of the bunch and the result he found is the same. Saw Dr. T., of Boston, and he is convinced he can cure it without losing any of the tongue. Dr. R., who is a surgeon, says it should be cut off. I can’t stop to write more details now. What I want to know is this:

“Don’t you think by internal treatment, etc., I can get over it? It is a very serious matter with me, you know, and if there is any way under heaven I can save my tongue, I am going to do it. \* \* \* I want you to give me your opinion as soon as you can.

“Yours truly,

“John S.”

This was in September, 1899. I replied reassuringly, telling him to go to a doctor and be treated for the disease that his blood revealed several years ago. One week after the above letter, number two was received.

“Dear Doctor:—

“Was delighted to hear from you, and I find you are of the same opinion as Dr. W., who has made a specialty of bunches. He is in Cambridge.

“He says it is a fibrous growth resulting from some injury

influenced by the condition of the blood. He laughed at the idea of tuberculosis and is of the opinion that my blood is in the condition you spoke of eight or nine years ago. So I am delighted to think I shall not resort to the knife.

"I shall follow Dr. W.'s prescription. I do not see how Dr. R. and Dr. M., of ——— College, could have made such a mistake. If I had followed Dr. R.'s advice, I would have had my tongue cut out by this time. I am dreadfully glad to hear of your opinion. I think I am on the right track now.

"Sincerely yours,

"John S."

Nothing more was heard from him, but while attending the musical convention at Worcester, Mass., in September, 1900, who should accost me in the aisle but this young man, looking more vigorous and stout than I had ever seen him.

He said: "I was delighted to get your letter. I was treated for the disease you mentioned and began to improve right away. My tongue is all right and I guess I am. I tell you," he continued, "they told me in that college that I would have to lose my tongue."

### TESTIMONY.

Desirous to know of others who had seen either form of this germ in this country, I began to inquire and look about, for my conviction from the first had been that it is a fact. But the attitude of the profession at large made me desirous of continuing my search, in the course of which, through Dr. J. S. Crane, I came in contact with Dr. John T. Metcalf, of New York, who was a man of uncommon intuitive diagnostic ability and an authority. He was at the time about seventy years old. I found him sick in bed with the gout. He, however, received me very kindly and my talk with him gave me renewed confidence and encouragement. He told me that I might say in regard to this germ that never had he known it

to be absent in syphilis. This was several years after it was pointed out to me.\*

My experience with the germ of inherited syphilis teaches me that it is almost impossible to remove it from the system. If a person has great vitality and uses it rightly, the chances are here better for its removal than in a person of low vitality or even in one of an inactive vitality, especially those who do not recuperate rapidly. In a person where the spores are inherited, the chances are far less dangerous than where the disease is contracted. I really believe that now-a-days most cases of inherited syphilis pass through life without showing any special lesion and many times in the present day without shortening life in the least. It necessarily follows that the acquired disease is the one which manifests the lesions in the shortest time and in their severest form. It also is the form which responds most quickly to remedial measures and is the most easily cured.

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\*See Bibliography.

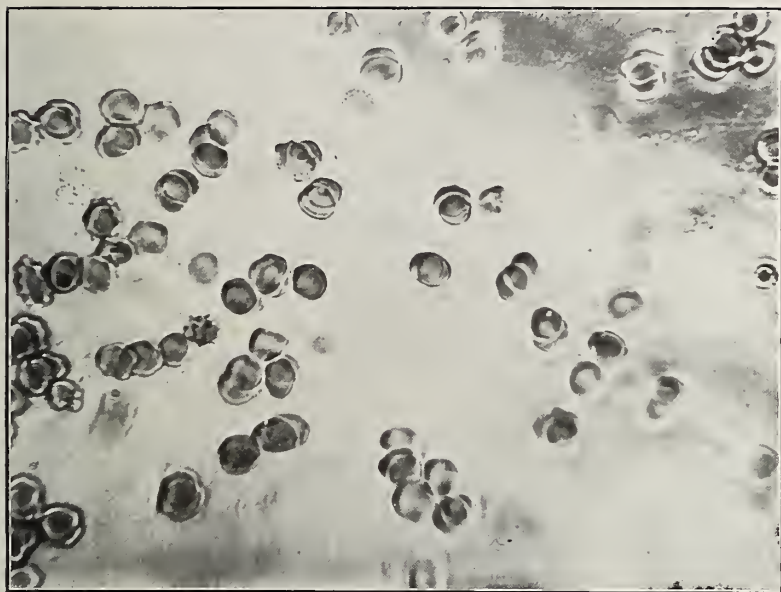


FIG. 82.—1-12 obj. Spores of syphilis, the leucocyte in upper left side of photo and also in the other white cell at the top of the picture. For more crypta syphilitica spores see fig. 49½.

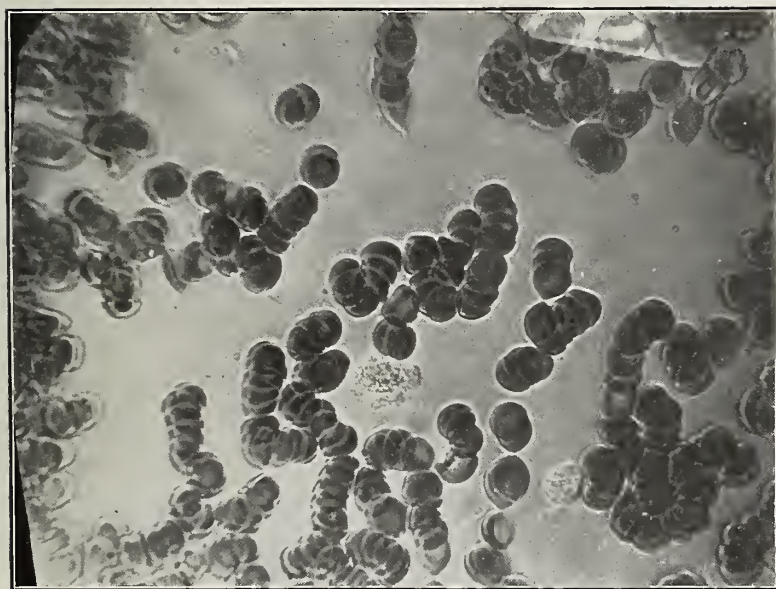


FIG. 83.—1-12 obj. Crypta syphilitica in both white cells here.







FIG. 84.—Syphilitic bacilli. (Golosz.)



FIG. 85.—Filament and bacilli (Golosz) mycelium or filament of crypta syphilitica.





MALARIA.



If the reader wishes to follow the subject of Malaria, and the new mosquito theory of its propagation, I refer him to other works on that subject, many of which are obtainable.



## MALARIA.

### CASE I.

In this photograph (Fig. 86) we have several stages of development of the malarial parasite, beginning with the unpigmented hyaline body. The patient was under the influence of quinine in Bellevue Hospital in 1894. The photomicrograph is taken with a 1-25 Tolles objective, direct sunlight exposure and no stains. Other works on the blood deal with this subject quite extensively.

There had been much work on the malarial parasites in the blood previous to the researches of Laveran; but my time has been so occupied with other investigations that little opportunity has been devoted to the work of many good researches. I, however, ask your consideration of the photographs which follow.

### CASE II.

This series of photographs was taken in Bellevue Hospital under the service of Dr. Charles L. Dana, in 1893.

A man by the name of Wilson had malarial fever, and when the pictures were taken he was under the influence of quinine. It will be noted that the leucocyte here is undergoing great contortions in its evident struggle with the body in its grasp. All three photographs, showing the leucocyte in its different pugilistic positions, were taken within ten minutes of each other. The white cells of the blood have been called the policeman of the body because they carry off the germs. Many times in the past few years I have thought that this body was a red corpuscle instead of the plasmodium.

This idea had not occurred to me when in Paris in 1895 I then tried to see Laveran, the discoverer of the malarial germ, but he was absent from the city. Therefore I wrote to him and enclosed the photographs shown here. Figs. 88-89-90. In reply the following letter was received:

Paris 19 juillet

Mon honore' cousin

N'ayant pas eu le plaisir de vous voir aujourd'hui et  
obligé que je suis de repartir demain matin je vous  
renvoie, ci-jointes, les photographies que vous avez  
bien voulu me communiquer. Les hématozoaires du  
paludisme sont difficiles à photographier néanmoins  
on peut obtenir des images plus nettes que celles  
que vous avez obtenues. Je regrette bien vivement de  
n'avoir pas pu vous voir j'aurais été très heureux de  
vous montrer les photographies que je possède.

Veuillez agréer l'expression de mes  
sentiments tout dévoués

A. Laveran

[TRANSLATION.]

PARIS, June 19, 1895.

VERY HONORED COLLEAGUE:

Not having had the pleasure of seeing you to-day and obliged as I am to set out again to-morrow morning, I send you herewith the photographs which you have kindly wished to show me. The hæmatozoa of malaria are hard to photograph, nevertheless one can obtain some images more clear than those which you have obtained. I regret very keenly not having been able to see you. I would have been very happy to show you the photographs which I possess.

Please accept the expression of my feelings very devotedly.

A. LAVERAN.



I will, however, leave it to the judgment of the reader as to what this prisoner in the leucocyte is if not some form of the malaria germ.

### CASE III.

The following letter from Dr. Hall, of London (who some years ago sent me some specimens of blood for examination), explains itself:

3 HIGHER MT. GOULD RD., GOLD COAST COLONY,  
PLYMOUTH, AFRICA, NOV. 13, 1896.

MY DEAR DR. WATKINS:

I am afraid the specimens I send will not be of much service for the information they give.

I received your answer just before leaving the Gold Coast, and as I was then doing district magistrate's duty, I had no time to see to this specially.

I came away with only two specimens (a and b), from a negro suffering from a marked attack of malarial rheumatism. I am afraid that they will be spoilt by now.

Specimens c, d, e are the cause of my sending the former, else I would not have troubled you. They are from three of my children, who were ill last week with epidemic influenza of a marked intermittent type. I send them as I found in the garden a patch of ground, over which they play constantly on a balcony, giving off a most perceptible foetid odor from having been soaked for some weeks, I discovered, with odds and ends of kitchen refuse and kitchen "washing up water."

Specimen f is from myself, it being taken just before writing this. I am now eleven weeks from the tropics. I return again in March, and will make a proper series of such specimens if I hear from you that specimen (f) is workable. Of course, if it be spoilt, it is not good to hope that good specimens could reach you from the longer distance.

Yours truly,

G. ROME HALL.

In accordance with my directions the blood was mailed in small boxes filled with wet absorbent cotton. Around the whole was wrapped lead paper, such as comes on tea-chests. I received the package about six weeks from the time it was mailed. The blood was still moist, and Fig. 94 is that of the negro. It shows the arrangement of the cells characteristic of rheumatism, although the outline of the individual corpuscles themselves has nearly disappeared. If one looks closely, a phosphatic crystal readily will be seen, indicating the form of rheumatism the man was suffering from. I did not see this myself until I examined the photograph for this work. I now see that there are several in the field.

The other photograph (Fig. 95) shows the germs that were found in the child's blood. It will be noted that it is filled with micrococci of some form.

#### CASE IV.

Fig. 91 is the plasmodium of Laveran from a soldier in the Cuban War. The crescent is seen in one cell and the pigment in the other red corpuscle.

#### CASE V.

Fig. 92 is a specimen of fresh blood taken in my office in 1896; this specimen is from the blood of a missionary who had been in the heart of Africa and there nearly died of the fever. The red cells are crenated and weak, showing a loss of their substance and great nerve depression. The large cell has a double contour, between which its granules or spores are seen, and is fairly well photographed. There is also apparent a large nucleus.



FIG. 86.—Malaria. See page 259.

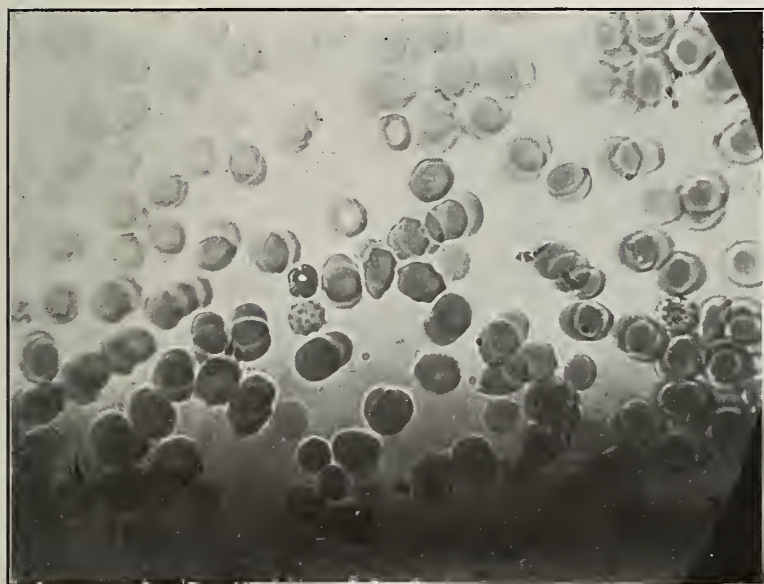
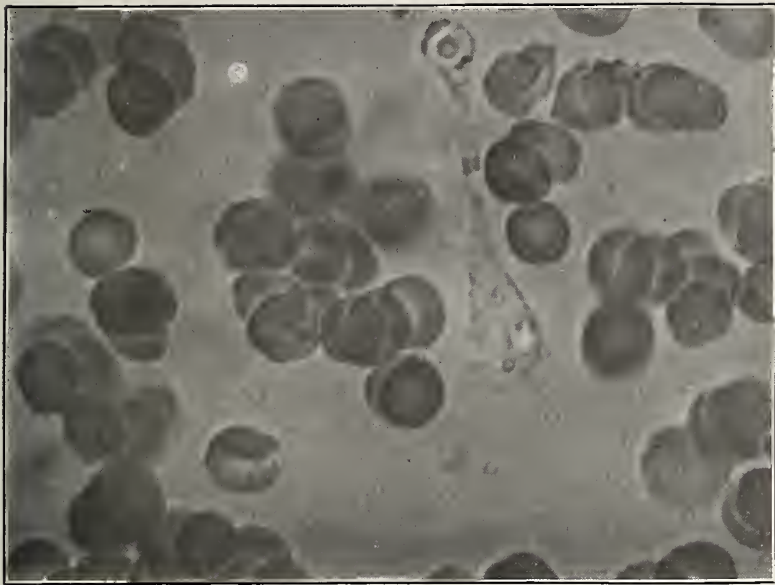
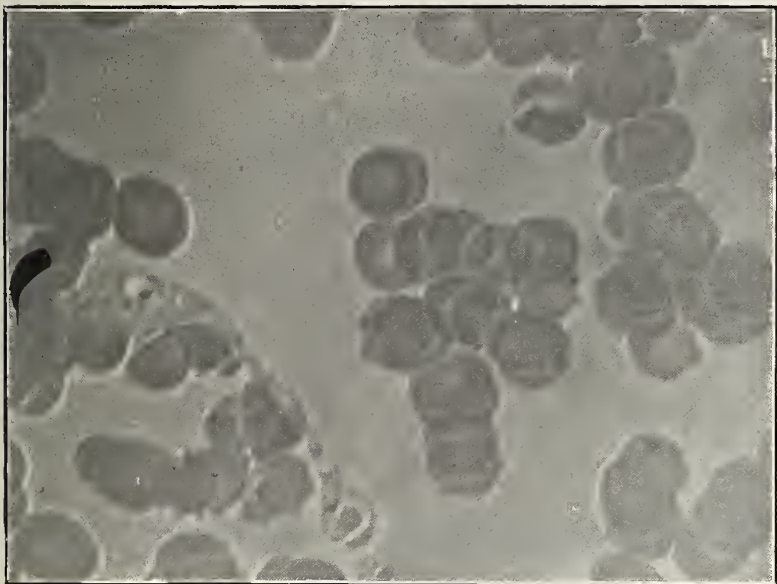


FIG. 87.—Malaria. 1-12 obj. hyaline body. (No text.)





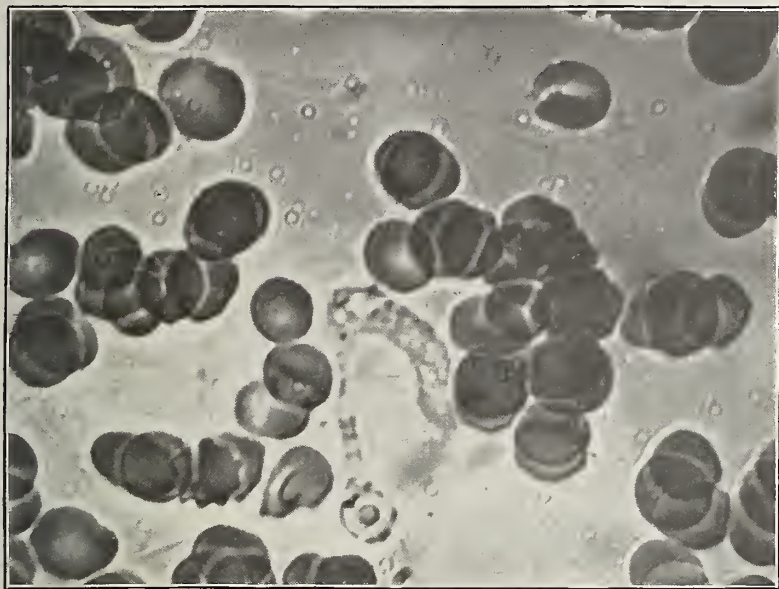
Case II, page 259.  
FIG. 88.—Ameboid white blood cell. (Leucocyte.)



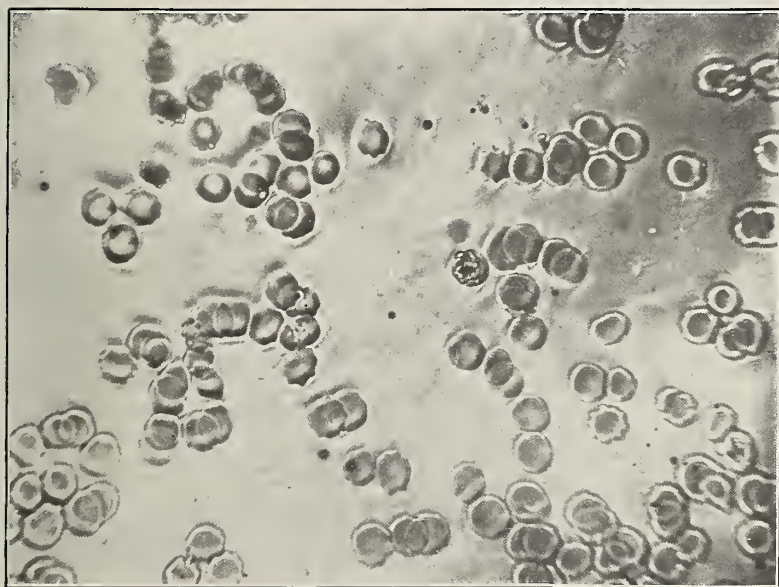
Case II, page 259.  
FIG. 89.—Ameboid leucocyte.







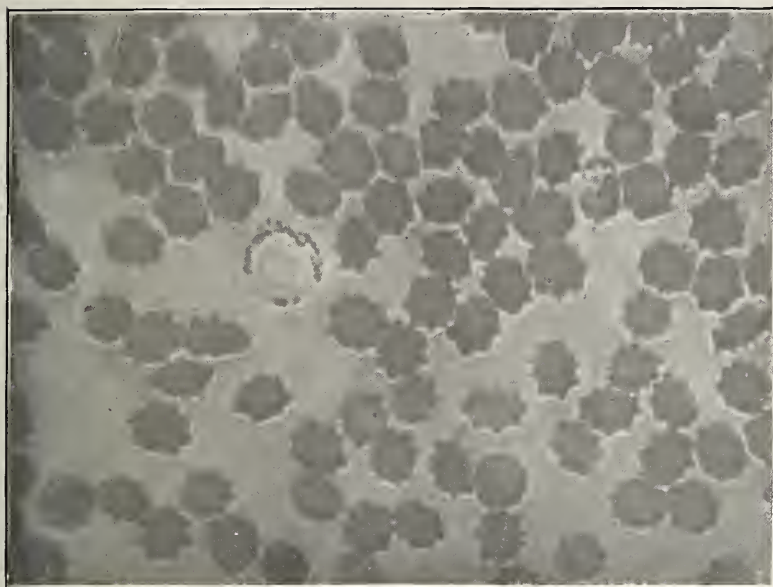
Case II, page 259.  
FIG. 90.—Ameboid leucocyte.



Case IV, page 262.  
Fig. 91.—Another form of the plasmodium. From a soldier who had taken malaria in Santiago. (Two in the centre of field.)







Case V, page 262.

FIG. 92—Double contoured cell from young man who had had the jungle fever in heart of Africa. Blood examined when he reached America.

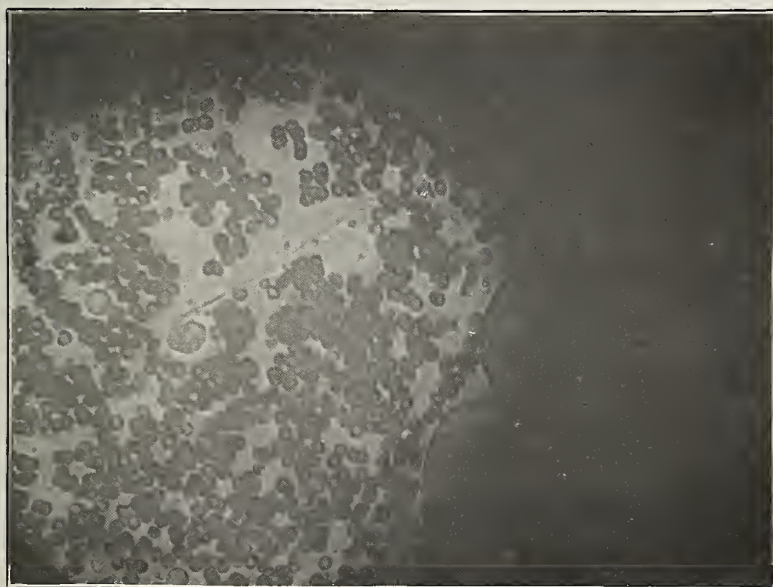
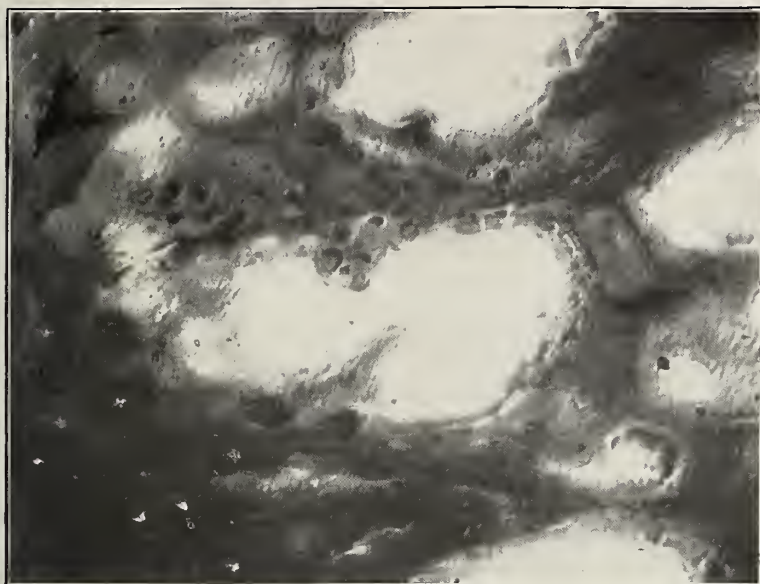


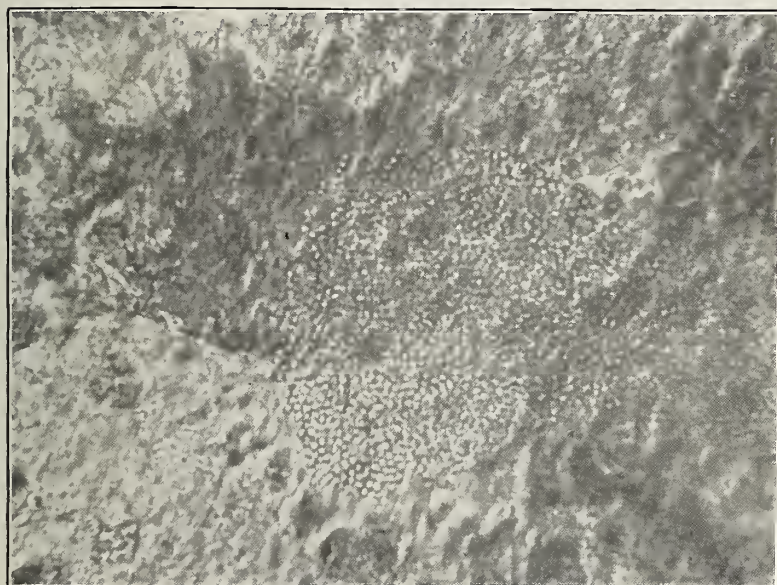
FIG. 93.—Showing the white blood cells spinning the fibrin. Photographed instantaneously. See page 278.





Case III, page 261.

FIG. 94.—Blood from African Negro, six weeks in transit. Phosphate crystal on right, rheumatic arrangement.



Case III, page 261.

FIG. 95.—Micrococci in blood. The ordinary Bauch & Lomb 1-12 objective was used here as well as throughout the book.



# WHITE BLOOD CELLS.

HOW AND WHERE MANUFACTURED.





Under this heading is considered the function of the white blood cell and a discussion of the present method of counting the leucocytes.



## LEUCOCYTES OR WHITE BLOOD CELLS.

### SYNOPSIS:

#### MADE IN THE GLANDS. WHAT MAKES THE RED CORPUSCLES?

For many years it has been known that the leucocytes were manufactured in the spleen and other glands of the body, and secondly that the red corpuscles were a product of the white blood cells of the body. My observations and photo-micrographs for many years have demonstrated this fact, but only a few of the profession were aware of the simplicity of the spinning of the blood discs by the activity of the spleen.

This process could easily be demonstrated on the screen with a little trouble to an audience of physicians by means of the micro-motoscope, probably showing the formation of the red corpuscles from beginning to end.

To-day, by culling quotations from German and American authors, the above statements in regard to the formation of the blood cells are verified.

Osler says that \**“Lowit regards the lymph glands, spleen and bone marrow as blood forming organs,”* that *“the nucleus of the leucoblast is relatively larger and contains one or more lumps of chromatin connected by radiating lines with the chromatin nuclear membrane.”*

From my work and observations I judge that this latter quotation, translated into plain understandable English means—that the nucleus of the young white blood cells contains the red blood corpuscle together with its cell wall, or membrane, and its fibrin.

The leucoblast is the young leucocyte, or white cell; the lumps of chromatin are the coloring matter of the red discs, the chromatin nuclear membrane is the cell wall of the red corpuscles, the radiating lines are the fibrin filaments of the blood, which are a part of the red corpuscles as well as the white, being much finer in the former.

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\* See Bibliography.

It is claimed by some that the fibrin is spun out from or by the white blood cells, and that a portion of this goes to form the red blood corpuscle. This corresponds with the result of my work and is demonstrated in the star-shaped leucocyte, a photograph of which is given below.

\*"Foa and Salvioli believe that the nucleated red corpuscles are recruited continually from the giant cells." This, it will be seen, coincides with my previous statement that the red cells are manufactured from the white (giant-cells are white corpuscles). Whether these red corpuscles have a nucleus or not makes no difference in regard to their place of formation. The nucleated red cells are nothing more or less than immature or malformed red cells. To complete the quotation: "Lowit believes that they (the nucleated red cells) are developed from the erythroblasts (nucleated red corpuscles in embryo). Malassez, Osler and others take the same view." Howell says: "On the other hand, a number of investigators, while admitting the absence of the nucleated red corpuscles in the spleen under ordinary conditions, have nevertheless classified it with the lymph glands under the head of the hemato-poetic organs, *because they hold that the colorless corpuscles are formed, are produced, in this organ.*"

As interpreted and understood these quotations seem to mean that we agree pretty well that all blood cells are formed in the glands, and that the red are formed from the white, as stated in the beginning. Fig. 93 shows the fibrin being manufactured or spun by the leucocyte.\*

I reproduce here one of my many observations (Fig. 96), the presence of the red blood cells in the leucocyte. I will not try to call the leucocytes by any of the poly-names, for they are too confusing.

There will no doubt be many views by those who observe the picture as to what it is. The nucleii were reddish and the white ameboid cell was very active. I thought at the time that it was a form of plasmodium, for the man had malarial fever.

Whether in this case these nucleii were due to a degenera-

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\* See Bibliography.

tive change\* or to a building-up process, I will not now discuss. But it is observable that the blood was in a very bad condition. Concerning the name for the leucocyte and its functions, as here illustrated, my opinion is stated above. Decisions as to its accuracy will be left to the judgment of time.

I also reproduce another leucocyte taken with a 1-25 Tolles objective, of a large red cell inside of the leucocyte. Some may think that this cell is over the leucocyte, but it is not. The red cell is within the leucocyte. Fig. 97.

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\* In the spleen red corpuscles have been seen in various stages of disorganization; some of them lying with the substance of the large, colorless corpuscles, and, as it were, being eaten by them (Foster's Physiology, p. 36).



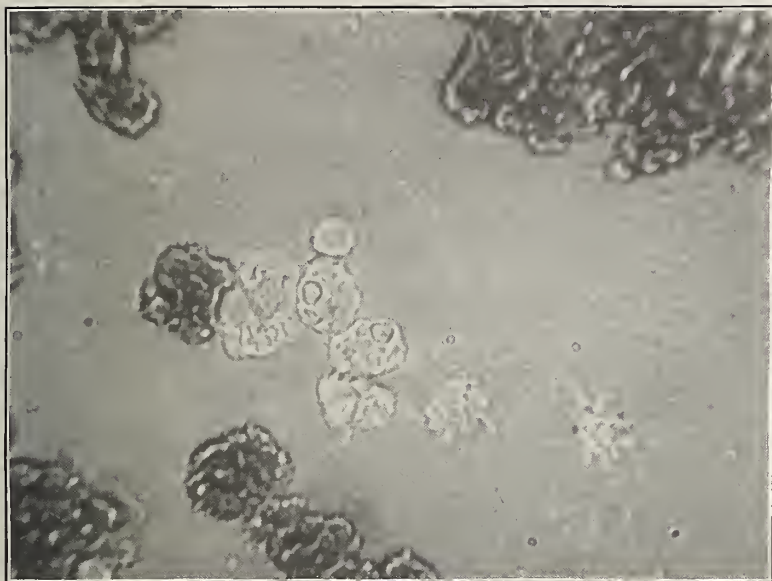


FIG. 96.—See page 278.

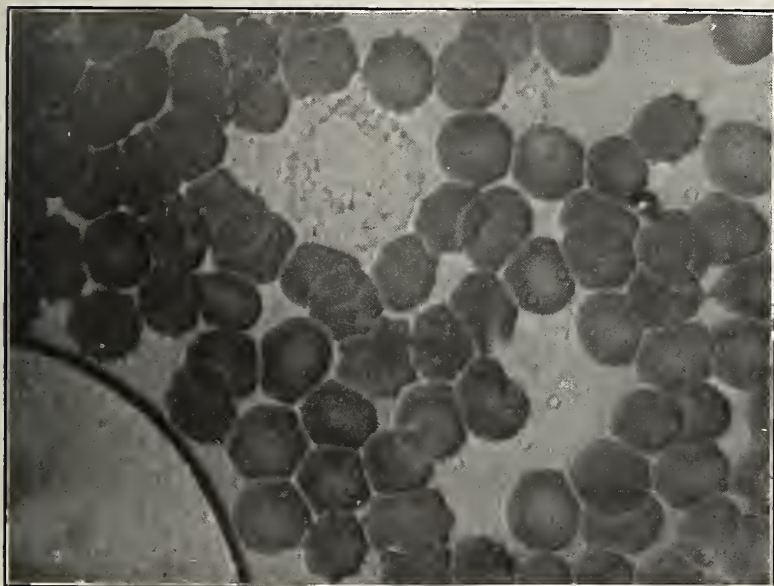


FIG. 97.—Showing red blood cell actually in the white. See page 279.





# LEUCOCYTOSIS.



## LEUCOCYTOSIS.

It is well known that the number of leucocytes varies at different times in the same person and in the same disease. It is also well known that different observers do not count the same number of leucocytes at the same time in the same person. There are great variations, especially after a meal, and in many unaccountable ways. These facts being well known, I ask: Does it pay to spend so much time in counting the individual cells, as is the custom? I think not, and prefer to rely on the gross number found in one or two specimens, estimated by the unaided eye in a few seconds. One's judgment in the matter is *practically* of just as much value as a count. Especially is this true for an examination of fresh blood. This is explained mathematically later on.

To illustrate, Fig. 103 shows an increase of white cells. The patient had trouble about the mouth, either in the teeth or jaw. There are here approximately 15,000 leucocytes to the cubic millimeter. These white cells being nearly all lymphocytes, you will look for abscess or pus formation, and in this case there was a small abscess about the teeth (pyorrhoea alveolaris). Fig. 104 would give a count of about 30,000; the location of the trouble is in the bowels, i. e., there is pain over appendix with a temperature of  $101^{\circ}$ . The leucocytes there fore, as a rule, will point toward free pus.

There is nearly always an increase in the white cells in abscess of any variety. Another fact I have often observed is that tuberculous matter is always present in abscesses or pus formations, and hence an absence of the tuberculous matter and leucocytosis together indicates that there is no pus.

Illustrations under tuberculosis show the leucocytosis in acute tuberculosis. It occurs in either tuberculosis or fibrous "consumption." And when the ameboid leucocytes predominate it is an indication that the bowels are involved in the tuberculous process or at least the mesenteric glands from which most of these cells originate.

## METHOD OF ESTIMATING THE DEGREE OF LEUCOCYTOSIS.

It is well known that the determination of the number of white blood cells is useful both in diagnosing disease and in determining the opportune time to use the knife in surgical operations. Some diseases have a slight and others a large increase in the leucocytes. In tuberculosis there is always more or less of an increase, while in other troubles—as in typhoid fever—there is either a diminution or they remain normal. A great deal also may be discovered from the kind of leucocyte present in the field. Theoretically each organ in the body has a white cell peculiar to itself, and when an organ needs repair it is the cell of this organ that multiplies and does the work. The same principle is seen in all nature, even in the labors of man. We have, for example, professional men for one kind of work and laborers for other kinds of work. If a railroad is to be built, or a stream to be spanned, the special laborer is called in to do the work, and the number employed is in proportion to the amount of work to be done.

Practically, there are very few organs in the body in which the corresponding characteristic cell can be recognized in the blood or anywhere else, yet it is known that in all repair there is an increase in the cells of that part whether it be in a chronic or an acute disorder. The white blood cells in the body have been referred to quite appropriately as the police force. Yet in the body, as in the municipality, some disturbances are settled without the blue uniform. When the law-restorers are needed, they come quickly or slowly, according to the suddenness or severity of the disturbance. So in the body; in an acute serious disorder they come quickly and in quantities; or if the trouble is chronic, these cells come slowly and according to the necessities. Thus in acute appendicitis, or any abscess, if rupture occurs, there is suddenly a leucocytosis in the blood which indicates an immediate operation. So there is an increase in the leucocytes in many diseases. I shall take up only those of which I have taken photographs, since other works deal more thoroughly with this subject than I care to.

I shall, however, explain the method I employ for counting the leucocytes, and it will be seen from the figures given that allowing for the difference in the ratio, the red cells can be estimated at the same time and in the same way.

The figures given here are with the ordinary microscope as used for general blood examination; by length of draw tube 160 millimeters (10 in.) the usual length of tube, with the usual eyepiece (2 in.). The figures will be given both for the 1-6 and 1-12 objective, the ground glass of the camera being 12 inches distant.

With the above conditions an ordinary field of the microscope covers a plate  $3 \times 4$  when developed. A red corpuscle on this plate measures 1-8 inch in diameter with a 1-6 obj. Hence the greatest number that will cover an entire field closely packed, edge to edge, is  $1-8 \times 4 = 32 \times (1-8 \times 3) = 768$ .

Another calculation. Surface of plate— $3 \times 4 = 12$  sq. in. Square surface of corpuscle  $1-8 \times 1-8 = 1-64$ ;  $12 \times 1-64 = 768$ .

With a 1-12 obj. the corpuscles measure 1-4 inches in diameter. Calculating this as we have the above we get 192 red cells to the field. Or 1-4 of the above (area)  $768 = 192$ .

There are from 300 to 400 red cells to one white in the normal blood.\* Hence two or three leucocytes to the field or photo-micrographic plate is normal according to the above figures:  $768 \div 300 = 2 +$  with a 1-6 obj. If the 1-12 obj. is used there will be one leucocyte to every two fields, reckoning 200 to the field. It will thus be seen without further explanation that the red cells are compared at the same time with the white. It is much easier, and just as practical, to speak of ten white cells to the field or to the normal number of red (350) and far easier for either the physician or the laboratory man to estimate by this method than it is for him to use the Thoma-Zeiss apparatus and the nomenclature adopted for that instrument. In fact, the everyday physician understands the former and he does not the latter. In using the above method, it is always best to get the average of five or six fields. This can be done in a few seconds with a little practice.

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\* See Tuberculosis, foot-note, page 25.

Dr. Alfred C. Croftan, in the "Journal of the American Medical Association," February 25, 1899, calls attention to this simple method of counting cells. He claims that there are normally one leucocyte on the average to every fifth field of his microscope. However this may correspond with the author's observation does not matter, for every man must decide this for his own instrument. In closing this subject, I quote one of Dr. Crawford's paragraphs:

"The counting of the red and white blood corpuscles is a tedious and, to all intents and purposes, an inexact procedure. Discrepancies, running into the hundred thousands in the red, and the hundreds in the white cells, will occur. Information sufficiently accurate for diagnosis can be obtained in this direction from a single glance at the colored blood-slide. The same, though not quite so radically, may be said of the determination of the hemoglobin; the percentile measurement of this constituent of the blood is a simple procedure with the aid of Gower's or Fleischl's apparatus; but it is not necessary, and in my experience again a careful and appreciative study of the blood-slide will give information that suffices for diagnostic purposes."



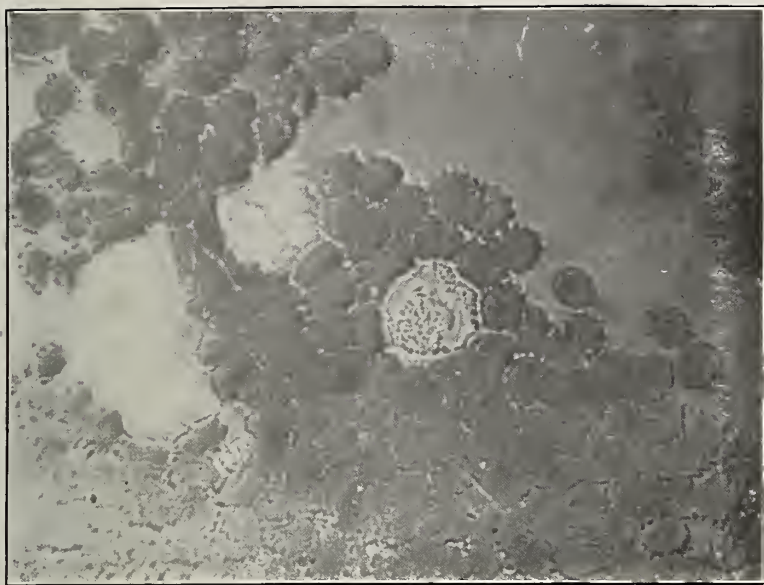


FIG. 98.—Leucocytes.

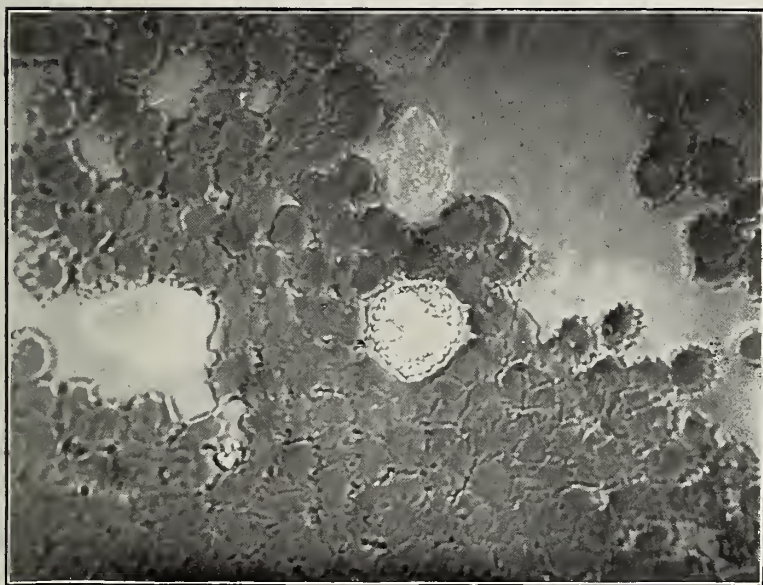


FIG. 99.—Same as Fig. 98, few minutes later, showing the changes that take place in the large granular white cell (eosinophilic cell).



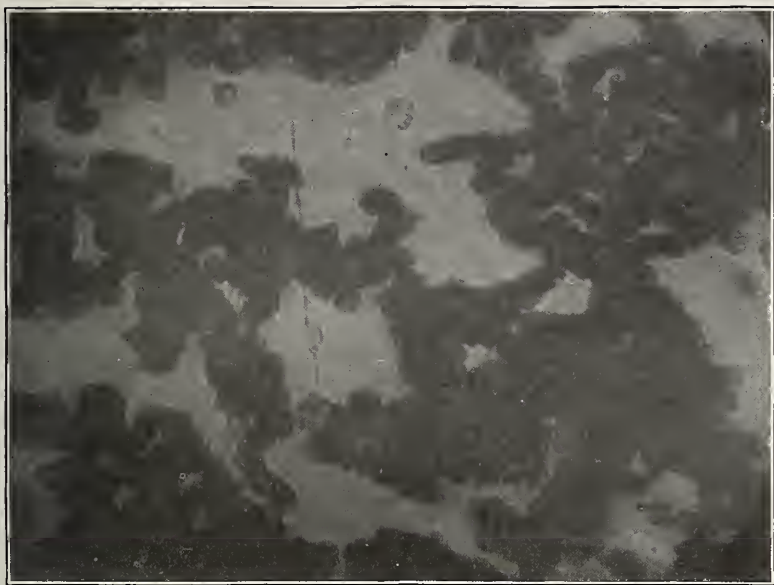


FIG. 100.—1-7 obj. White blood cell with long thread-like prolongation.  
Figs. 101 and 102 are the same cell in the same position with a higher power.

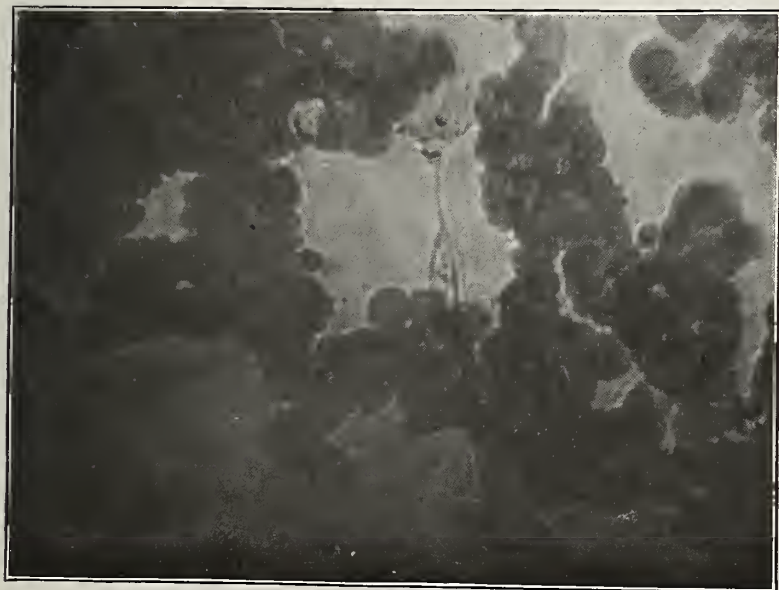


FIG. 101.—1-12 obj. Not room enough on one picture to show all of this white blood cell with this high power. The rest of the field, including it, is shown in Fig. 102.



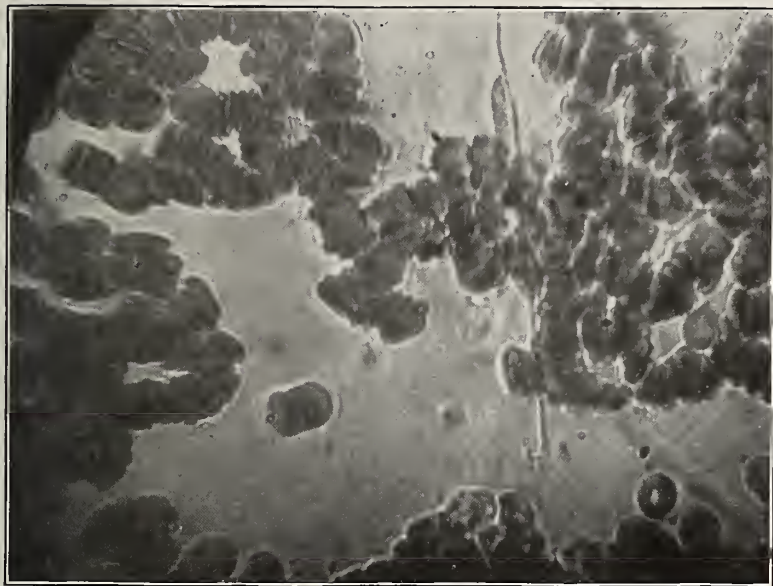


FIG. 102.—Remainder of thread-like process of leucocyte. Probably after some enemy.

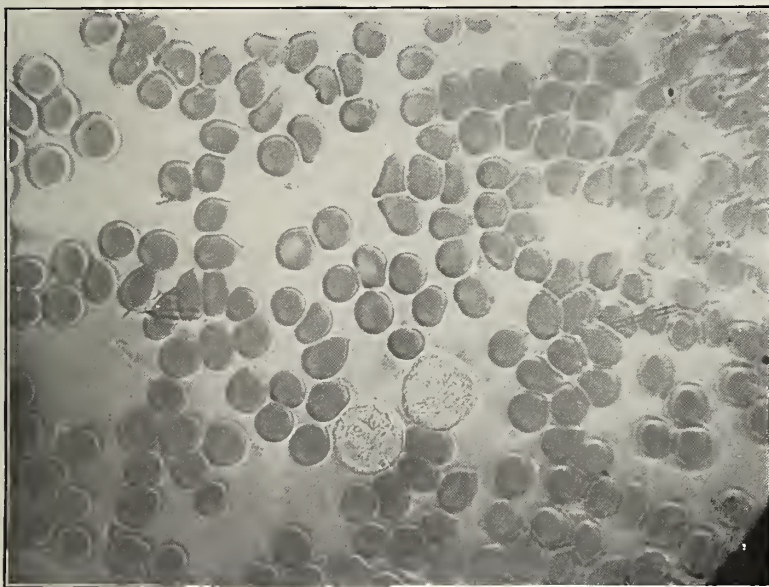


FIG. 102½.—1-12 obj. White cell returned to normal round shape.





## LEUCOCYTOSIS.

### REMARKS ON THIS METHOD FOR COUNTING BLOOD CELLS.

It will be said that the above figures are not absolutely correct for the number of cells is given arranged edge to edge. If the cells were arranged in perfect rouleaux (the cells measuring 1-16 in. for 3 with the 1-6 obj., 2-16 in. for 3 with the 1-12 obj.) there could then be seen in the field 4,608 and 1,152 respectively. This never occurs. If it should the blood would be perfectly healthy, and there would be no need of a count. If it did, there would be 15 whites to the field in the first instance and 3 to 4 with the 1-12 obj. and the blood would still be normal, in fact, theoretically healthy—an impossibility. Infants' blood comes the nearest to this and then the rouleaux are short. Quite often there are a few cells in rouleaux and sometimes half the field; but this is readily taken into consideration with a little experience in estimating.

Again, this method can easily be transformed to that used by the Thoma-Zeiss apparatus if desired. If in the field of the microscope there is one-half the number of red or twice the number of white cells normally present, then there are only 2,500,000 and 16,000 to the cubic millimeter, respectively, by this method, and so on according to the proportion. One method is easily translated into the other. (See Figs. 103-104.)

With the hemacytometer it is the custom to consider normally 7,000 white cells to the cubic millimeter, and 5,000,000 red ones. The counts of the former can readily be made to correspond to the latter method by a slight calculation as above. At the present day the latter method is the accepted one, but it is not the most simple. At the same time the method is a good one if one is willing to take the time necessary for a dry count.

When I was studying higher mathematics, the professor told the class that no one could remember how to work out all the formulas, but the fact that we once knew how and did so was sufficient. So if one has once known how to count the



blood-cells with the Thoma-Zeiss apparatus, that is sufficient. Such can use the former method and if necessary translate their figures into the latter way of counting, for one is just as accurate for practical use as the other. If one wants to use the dry method and has the time let him do so.

In discussing this point recently with a physician who believed in using the latter method only, he said that he was called a few days ago to make a count in a hospital for an opinion in regard to a diagnosis. It seems the resident physician had made a leucocyte count of 60,000. My friend made the count, I should judge, about an hour after the former, and he made the number 15,000, he said. The result was that the operation intended was not performed. I maintain that so long as the surgeon had the most confidence in the latter man's count, that his count by the other simple method would have answered the same purpose, and might been done in one-fiftieth part of the time. In fact, the surgeon can learn to make the calculation himself; for it is simply a matter of judgment. In view of the fact that two unacquainted and independent observers can scarcely come within 20% of each other\* by the Thoma-Zeiss apparatus, it seems that the method first mentioned is the one to be preferred.

If the surgeon in a case to be operated upon is not accustomed to blood examination, he should give the symptoms to one who is and in whom he has confidence, and let him by his blood test determine whether or not there shall be an operation.

The method of counting in common vogue and the figures given by different operators reminds me of an adage in regard to the three kinds of statements, each one being a little more inaccurate than the previous, viz:—"Lies, damned lies and statistics." Really, the value of any blood-count is only approximate. The number of passengers carried on the railroads in India has increased from 2,000,000 in 1857 to 160,000,000 in 1896.\* Here is a vast difference, and figures are of service to convey some idea. This illustrates the value of blood-counts;

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\* See Bibliography.

for, unless there is an enormous difference between the count at one time and that at another, the figures are of no value. Therefore, one method of estimating is just as accurate as the other. The more simple is therefore preferable, and that is by estimating without the hemocytometer.

I have given the maximum and the minimum blood-counts in a definite field of the microscope. Actually and practically it is difficult to pick out all the leucocytes or red cells in a field because of their piling on top of each other and their cleaving together. Therefore, according to my experience in normal blood with a 1-6 obj. and a 1-12 obj. there are respectively 2 to 3 and 1 to 2 leucocytes to the field with the ordinary No. 1 eyepiece. Whether the red cells are diminished in proportion to the serum or not can be told with a little experience by the proportion of red cells in the field and the way they float about.

The following opinion is based on up-to-date hematology. It is placed here because the discussion hinges on the dry method of blood examination. Such examinations rely for their results mostly on the number of cells in a given field by the Thoma-Zeiss method of counting.

The problem of the examination of the blood for clinical purposes has been approached from two standpoints. One of these is that of the hematologist, the other that of the clinician; and curiously enough—or perhaps the matter is not so very curious, because on almost every question of methods this same result has ensued—there has been a considerable lack of agreement between the two parties, the clinician arguing that the results are too indefinite to enable him to diagnose his cases with accuracy; the hematologist, that the clinician—insufficiently familiar with the technique employed—is incapable of interpreting the results accurately.

As a matter of fact, we believe that in this dispute the fault lies largely with the hematologist, for if his results are not sufficiently precise and conclusive to enable the clinician to use them in his actual practical work, they are, from the clinical standpoint, of minimal value. Furthermore, if his reports are returned to the clinician so late that the latter is com-

pelled to act upon the ordinary symptoms and signs of disease before receiving them, their value can be regarded as nil. On the other hand, the clinician, as the man upon whom the responsibility for action is placed, has the right to demand precise, definite reports, returned in the briefest possible space of time, and when such reports are not forthcoming, his criticisms and complaints are fully justified.

Dr. John B. Deaver, of this city, is undoubtedly a man whose clinical experience in surgery has qualified him to speak upon the question of surgical diagnosis; and as a man employing, or having employed for him, all methods of the ward or laboratory to confirm his diagnosis, he is qualified to express an opinion upon such methods that is worthy of the most respectful consideration. Recently he has called forth the protests of certain hematologists by his criticism of the value of blood examinations in surgical conditions, and in his most recent article, published in this number, as a sort of reply to these protests, he has reviewed the entire subject of blood examinations. The one point concerning which there has been the greatest amount of dispute is the value of leucocytosis as a symptom of disease. Now leucocytosis, it must be admitted, is a sign of certain general states, and practically never a distinguishing sign of a particular local lesion; and when Dr. Deaver argues that it is insufficient to establish a differential diagnosis between tubal suppuration and appendicitis, he assumes a position that is absolutely unassailable. We think that on the whole his standpoint is a good one; that leucocytosis is not to be regarded as a final arbiter in questions of operative interference, but that it is simply a contributory symptom of considerable value, not yet as thoroughly understood as it might be, but never to be entirely neglected in any case.—Editorial, the Philadelphia "Medical Journal," November 23, 1901.



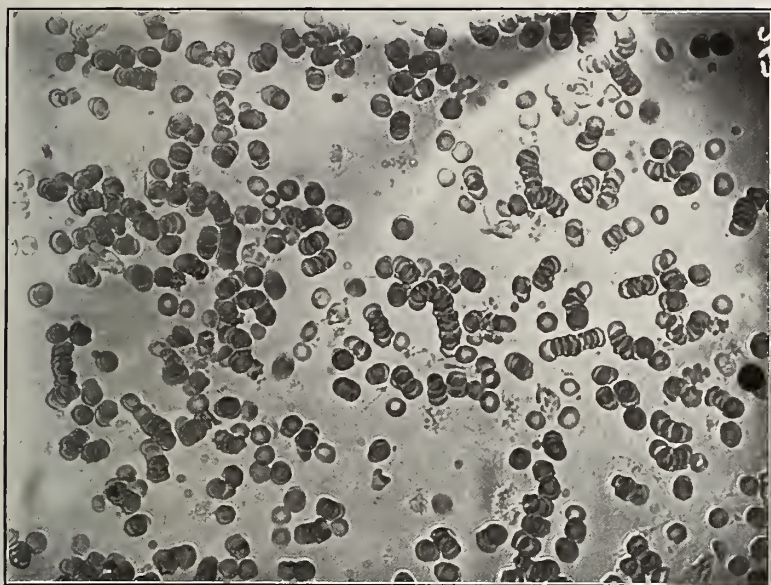


FIG. 103.—About 15,000 white cells here to the cu. m.m. See also Fig. 134 on page 363.

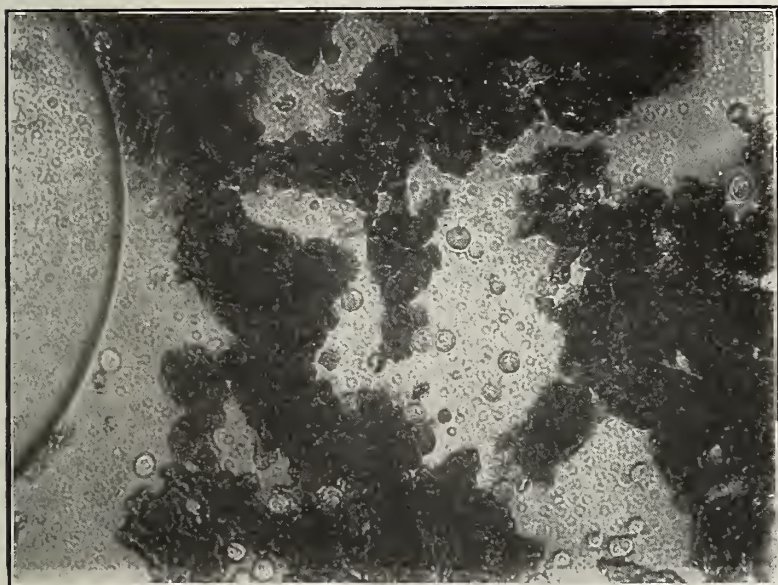


FIG. 104.—Increased white cells, about 30,000 to the cu. m.m.



# FURUNCULOSIS

(BOILS.)





The young man from whom this drop of blood was taken had a boil on the back of his neck. I show the photograph to illustrate the increase in the number of white cells in furunculosis, and also to illustrate the method of keeping a permanent record which may be referred to at any time, with the actual number of cells in the field. Fig. 105. The second photograph is taken after the boil had discharged and healed. Fig. 106. In it there will be noticed the return to the normal condition—one or two white cells to the field.



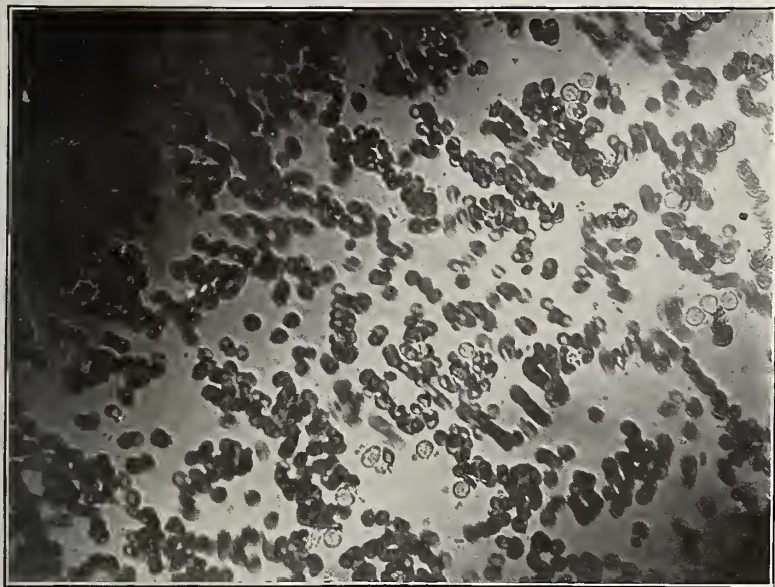


FIG. 105.—Increased leucocytes in a case of a boil.

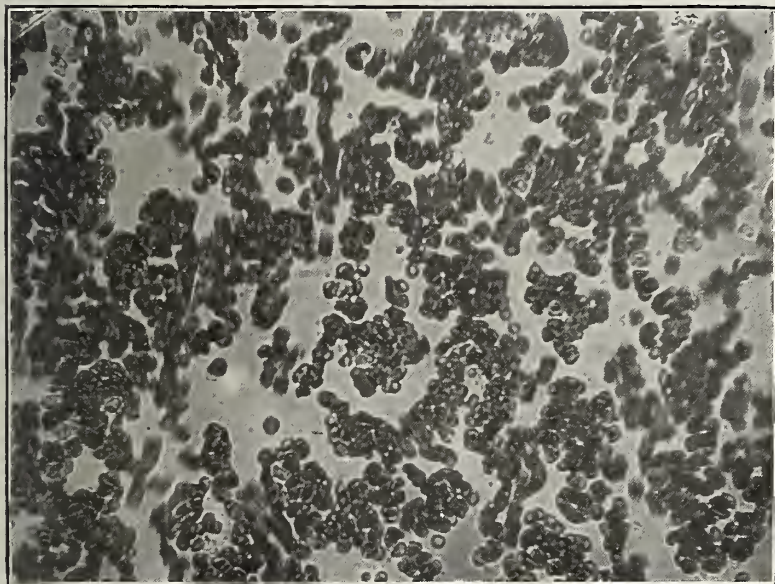


FIG. 106.—After the boil had healed. Showing the disappearance of the white corpuscles.



## NEUROSIS.

IT IS FOUND THAT THESE CELLS ARE FOUND MOSTLY  
IN PERIPHERAL NERVE AFFECTIONS.



## NEUROTIC CASES.

### MICROCYTES.

My observations have shown that microcytes are abundant in many neurotic disorders and in some of the diseases classed under the head of diseases of the nervous system. They are more noticeable, however, in functional nervous disorders, in which the patient is fidgety and when there is loss of nerve force due to overstraining of the mind in business cares, also to lack of harmony in the sympathetic nervous system. According to Vierordt,\* Osler and others, these microcytes are abundant in pernicious anemia. My theory as to the cause of this is that the nerve fluid does not have time to complete its normal circuit and thus the blood corpuscles do not have time to attain their true size and the result is these "dwarf corpuscles" or microcytes. Therefore I class this appearance under the head of neurotics.

### CASE I.

A banker was visiting me one evening. Being of a scientific turn of mind, he asked me to photograph his blood simply to show him the work and how it was done. I did so, and as the picture began to develop before us in the dark room, these dwarf cells became faintly visible; I thought to myself: "This man is nervous, fidgety, always on the rush." So, as the picture finally came out, I said to him: "If I did not know you I would think from this picture that you were a very nervous man."

He replied immediately, "Why, I am. I can't keep still ten minutes. I am always on the go, and I wish I could get over it."

Although I had noticed his condition before, this seemed to confirm it; and from that time on I noticed the appearance of these microcytes more and more in neurotic people.

The photograph of this man's blood taken with a 1-12 obj. and low eyepiece is shown (Fig. 107).

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\* See Bibliography.



## CASE II.

The isolated small blood-cells in the second picture (Fig. 108), remind one of the microscopical appearance of milk. John Hunter, in his book on the blood, written in 1796, reports two cases of women from whom he took blood (venesection), and he said it resembled milk even under the microscope. It "had no color when drawn," and hence looked milky. Dr. George Dock, of Ann Arbor, if I remember correctly, recently read a paper relating a case in which he said the blood was white, due, however, to the large number of leucocytes.

I am not aware that these cells referred to above have been investigated by any other observer in this connection; and I think that their discovery is original with me.

## CASE III.

The blood shown in this photograph (Fig. 109) is that of a man weighing 200 pounds and not over 5 feet 10 inches in height. He has the appearance of perfect health; but he says that it is difficult for him to go out of the house because of fear that something should happen. The large number of microcytes (small red cells) here, the crenated edges and the watery condition of his blood indicate that he is in a neurotic condition. One would think from this man's looks that he is a good subject for apoplexy of the embolic variety. But it is not so. He is more likely to have paresis. There is no rheumatism here, yet there is a condition which does not show in the picture, and which might be the cause of this whole disorder.

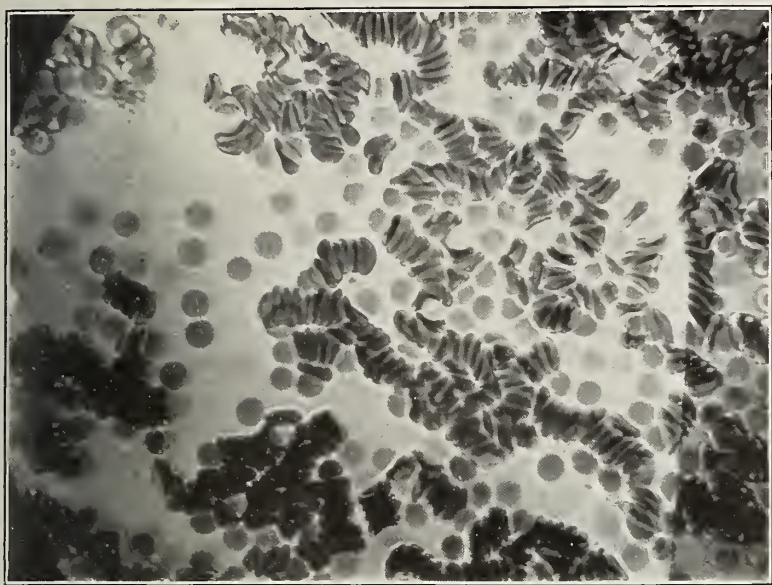


FIG. 107.—Microcytes in banker's blood.

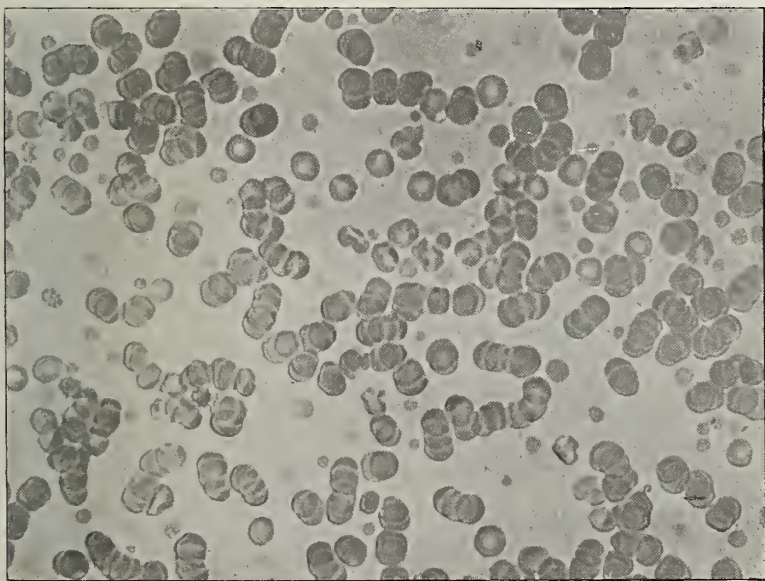


FIG. 108.—Milk globules (apparently).



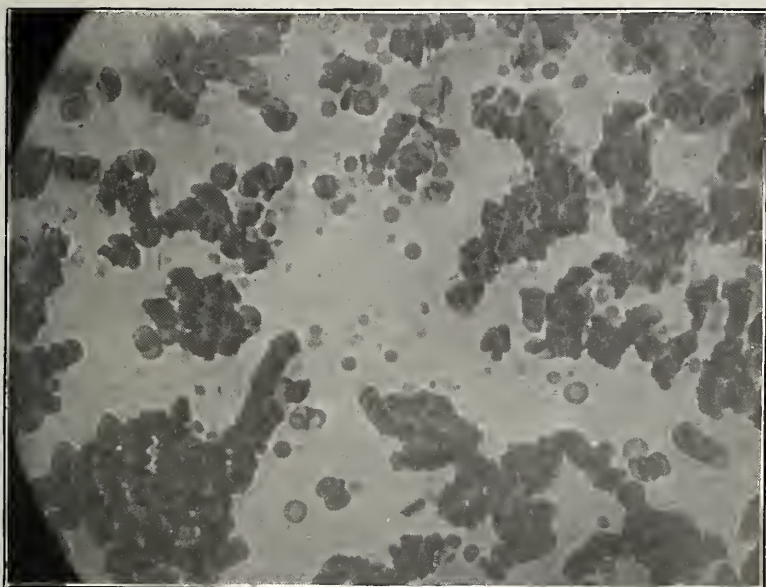


FIG. 109.—1.9 Zeiss obj. Paresis.

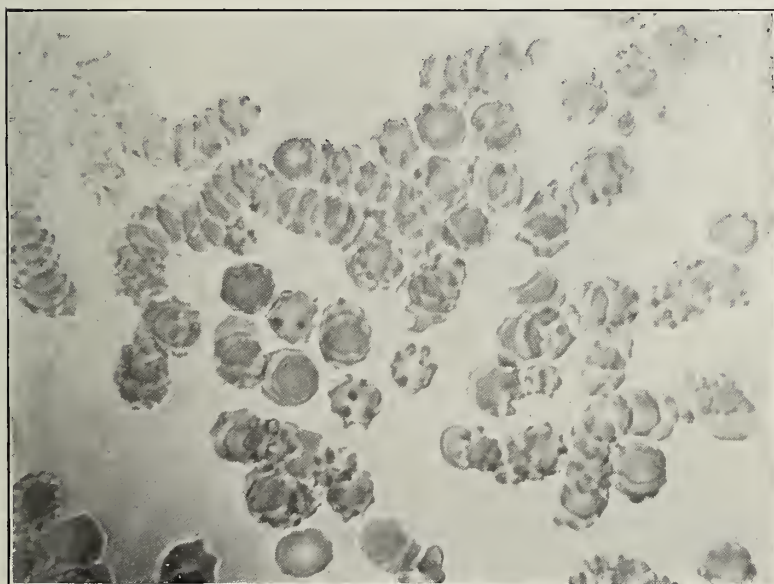


FIG. 109½.—Two Microcytes in the field. (No text.)



# POIKILOCYTES.

DEFORMED OR WEAK RED CELLS.





## POIKILOCYTES.

### ILLUSTRATIVE CASES.

#### CASE I.

Poikilocytes are deformed red corpuscles. Those shown here are taken with a 1.6 D Zeiss objective. (Fig. 111.) When these are found in the blood of a person, it is simply an indication of weakness, a run-down condition due to some cause, known or unknown.

It was first thought that these cells were indicative of cancer and later of pernicious anemia, but now they are known to be diagnostic of neither, for they are found in many conditions and simply mean, as does a slight increase in the white cells, that we must look further for the trouble, inquire into the cause—in other words, study collateral symptoms.

In another case here illustrated (Fig. 112), the man was nervous, fidgety and weak, and had a great deal of trouble with his eyes. All this was due to lack of nerve power, caused by overwork. He sold out his business and retired; and I understand is to-day feeling better than ever before in his life.

#### CASE II.

I reproduce this photograph (see Fig. 110), not for its beauty and technical art, but because it contains—besides the poikilocytes of Ehrlich—great quantities of the invisible corpuscles of Norris. They can best be seen with a hand magnifier and are most noticeable in the upper corner of the photograph. They were not discovered until I examined the negative a few days ago, yet the photograph was taken three years ago. According to Osler, they are the red cells before they have received their coloring matter. (See American Text Book of Theory and Practice of Medicine, in which he merely alludes to the fact.) In 1885 Norris, an Englishman, wrote a book on the subject which contains good photo-micrographs.



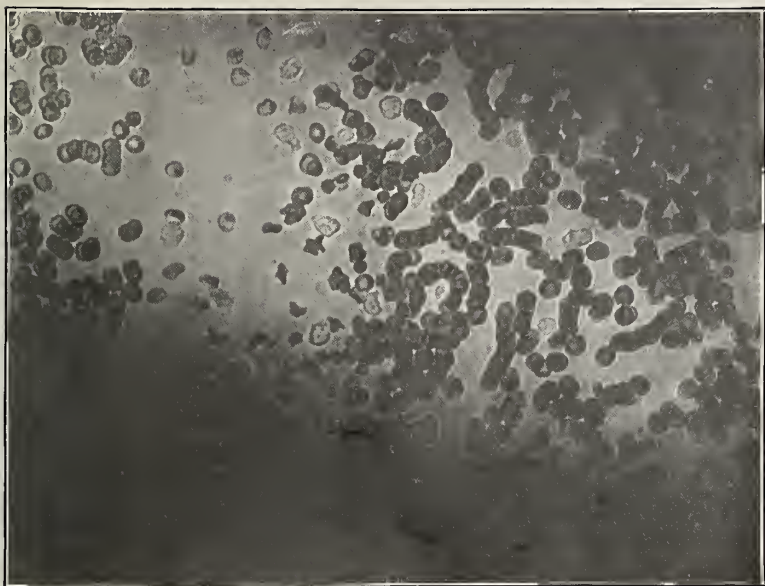


FIG. 110.—Invisible corpuscles of Norris seen in the serum between the cells, in upper left-hand corner.

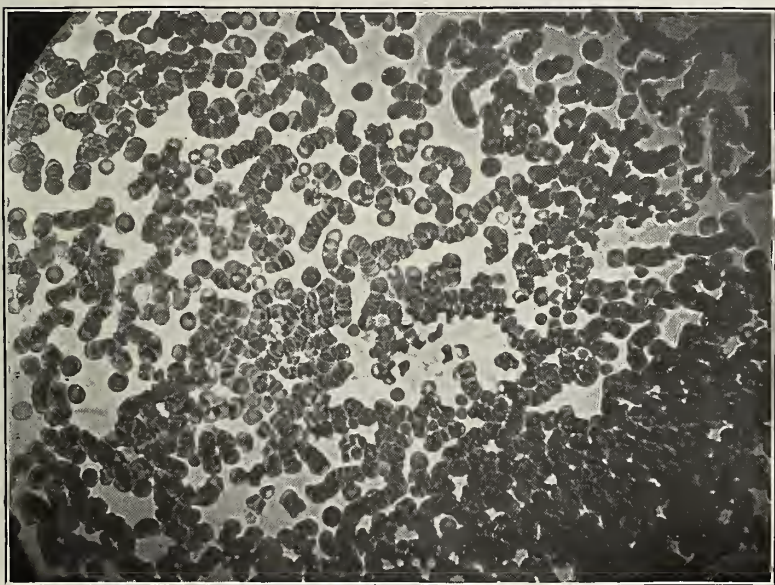


FIG. 111.—Poikilocytes. They are the irregular and sometimes half-moon shaped cells. Are also invisible corpuscles in the field.



**VITALITY.**



Flabby, irregular cells indicate weakness in proportion to their number. Many full, round cells indicate proportional strength and vitality.





## VITALITY.

The nervous strength or vitality of a person is, so far as my observation goes, always indicated by the roundness of the red cells. If the cells are flat or crenated, there is a low state of vitality. The former condition is present in long-continued fevers and in low chronic disorders. When a person is about to die from such disorders, the anemic flabby crenated red disc is often very marked. In a strong healthy individual the roundness and elasticity of the red discs are characteristic. This latter is often disguised by rheumatism, in which the cells are sticky, but even here, with experience, the difference can be seen.

When in Paris in 1892 I showed a French physician a photograph of blood from a living man in which the cells were mostly crenated; he remarked immediately that it could not be correct, for if blood like that came from a man he would be dead. So the fact comes up again that something depends on the way the blood is drawn and the time that elapses in getting it on the slide. If such blood as was shown the doctor in question was crenated to that extent in the system, I agree that the man would be on the point of death. But the picture was taken about one-half hour after it was drawn.

## CASE I.

The specimen of blood pictured here is from a prominent Senator. Fig. 113. The crenation of the red cells, together with the increased number of leucocytes, shows simply one thing—the man is weak, in fact he is sick. No well man's blood will, when freshly drawn, give that appearance.

In this case, examination made seven months before death showed clearly the signs of impoverished blood.



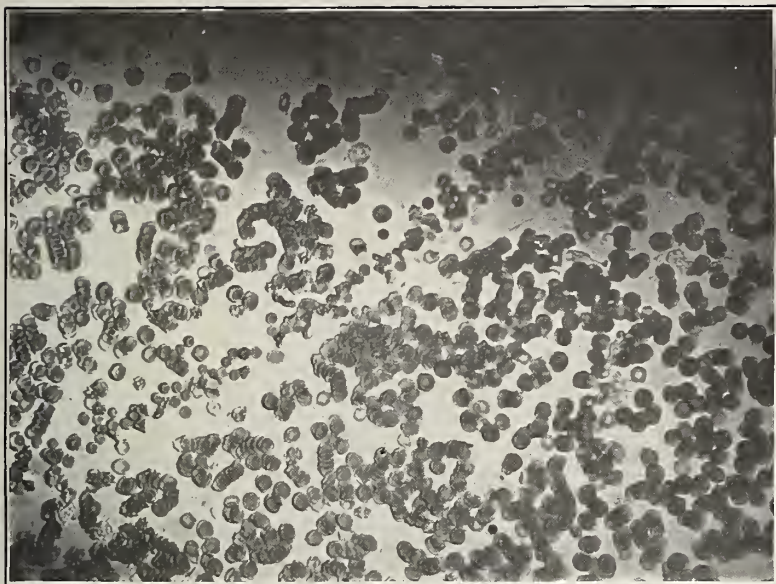


FIG. 112.—1-6 obj. Poikilocytes scattered diagonally across the centre of the picture.  
See page 317.

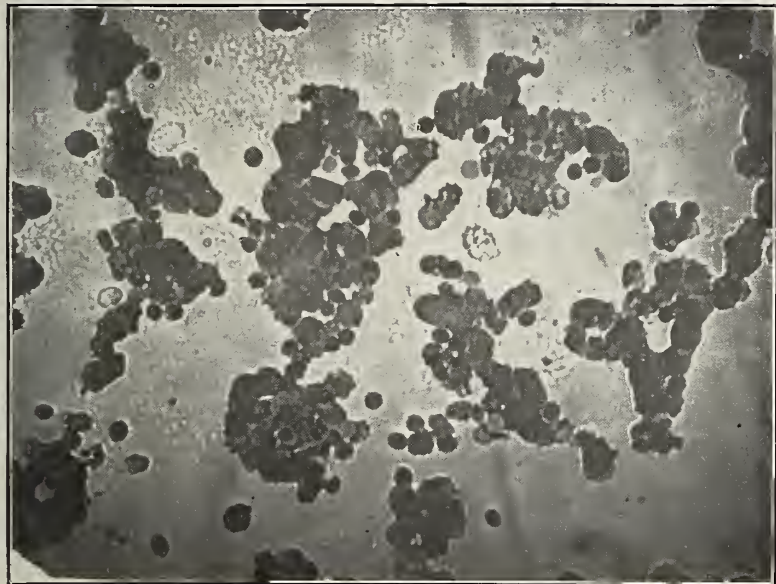


FIG. 113.—Photograph of blood of a Senator. In this case the examination, made seven months before death, showed clearly the signs of impoverished blood and low vitality.



## FOREIGN MATTER.





These pictures are shown to put the reader on his guard; for extraneous matter which inadvertently creeps into view under the microscope must be constantly kept in mind.



## FOREIGN MATTER.

The more one knows about the microscopic appearance of dirt and plant life, the less he will have to use asepsis in the microscopic examination of blood, barring the danger of infecting the patient, and the more simple the examination becomes. Many errors are made in analysis of objects seen through the microscope. The objects thus seen and supposed to be in the blood would fill a small book full of interesting pictures. (Dust floating in the air, epithelium and dirt on the surface of the skin, such as tobacco dust and starch granules from various sources.) Imperfections in the glass slides are sometimes a bothersome source of error. Dust on the eyepiece is very common; but this is easily distinguished by revolving the lens in the tube with the fingers.

In 1890, when making photo-micrographs of the blood of patients on North Brother Island during the typhus fever epidemic, the fine dust was so abundant that it was impossible to get clear photographs. There seemed to be a storm of dust all the time I was there. These particles are often mistaken for fine germs. Many glass slides obtained from reliable manufacturers contain defects such as air bubbles, specks of apparently unmixed metals, together with long streaks, due to some unknown cause. The most perfect glass for a slide that I ever obtained was from a mirror taken from one of the United States Government sextants. Photographs of a few only of these particles of foreign matter and glass defects are shown here.

The following are a few foreign bodies often found on the microscopic slide other than those existing in the blood:

Gravel.

Cotton fibres.

Silk.

Feathers.

Epithelia.

Granules of starch.  
Granules of wheat.  
Beard of wheat.  
Fruit skins.  
Eggs and larvæ of insects.  
Fibres from carpets.  
Hairs from beard.  
Oils.  
Spores of cryptogamic plants.  
Cooked food.  
Uncooked food.

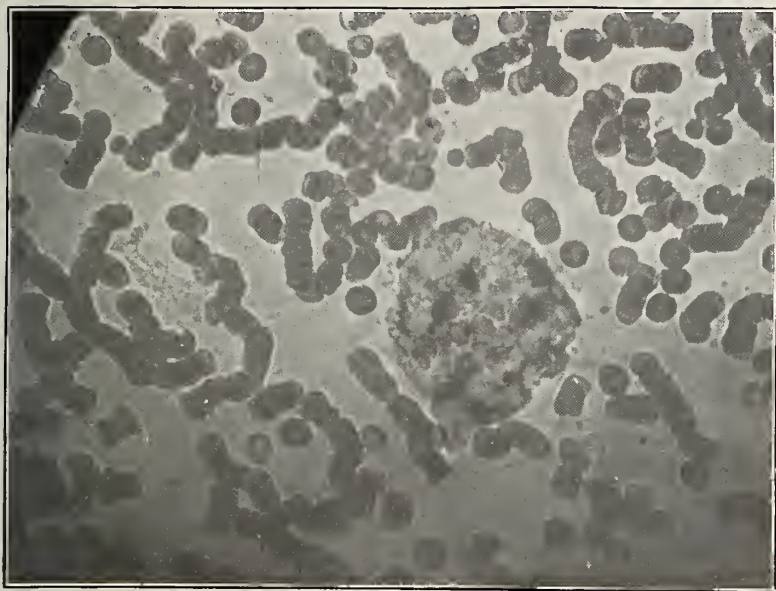


FIG. 114.—Flaw in glass slide.

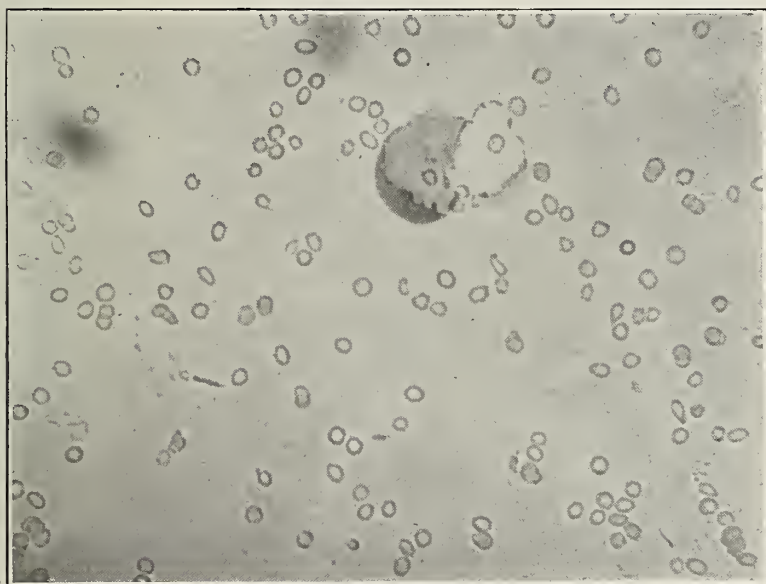
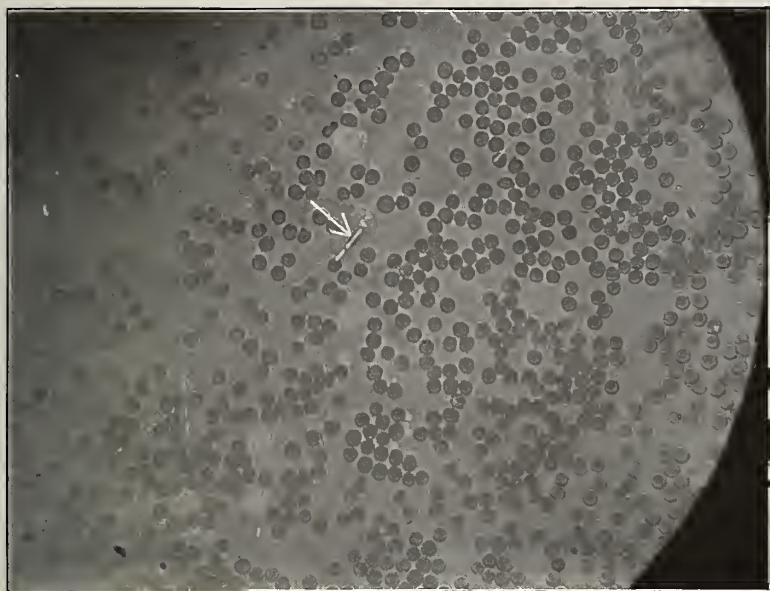
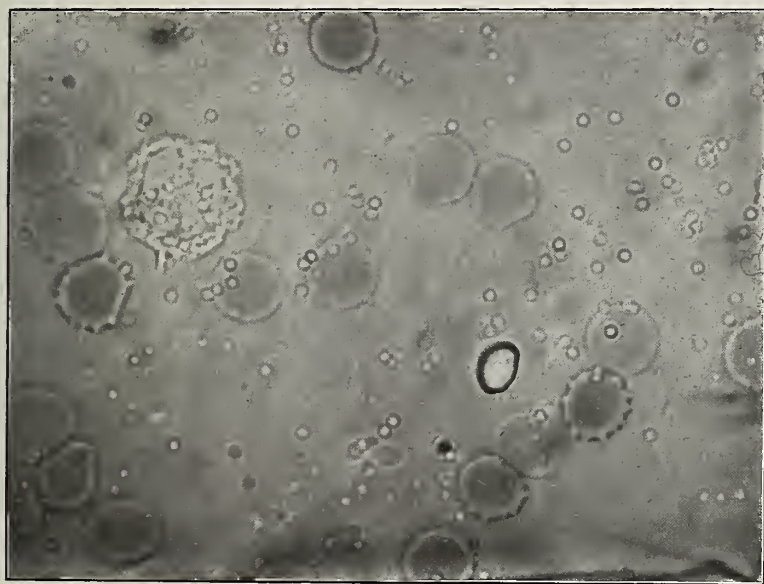


FIG. 115.—Flaw in the glass.





Defect on the glass—probably a thumb mark.



Bacillus about to be absorbed by the leucocyte in a case of advanced tuberculosis.  
(Taken in 1894.) Also a defect in the glass at the right of the centre,  
and many dust spots which are on the eye-piece.





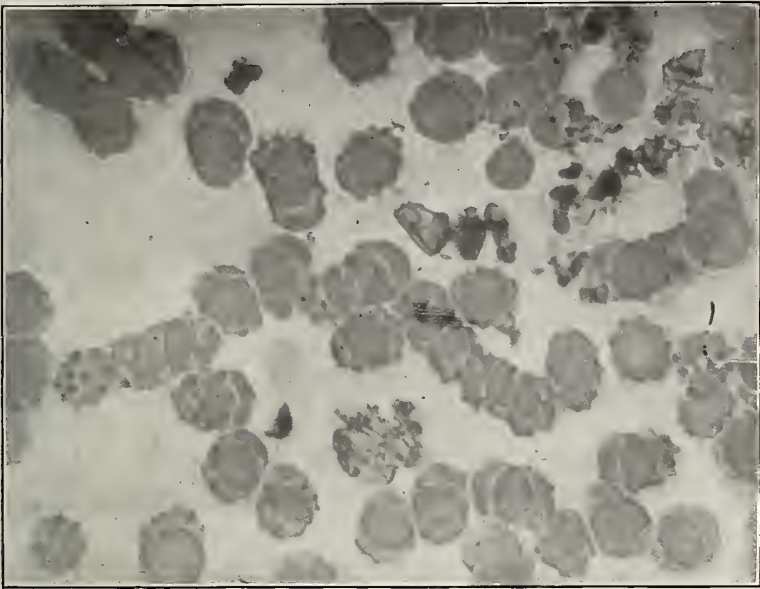
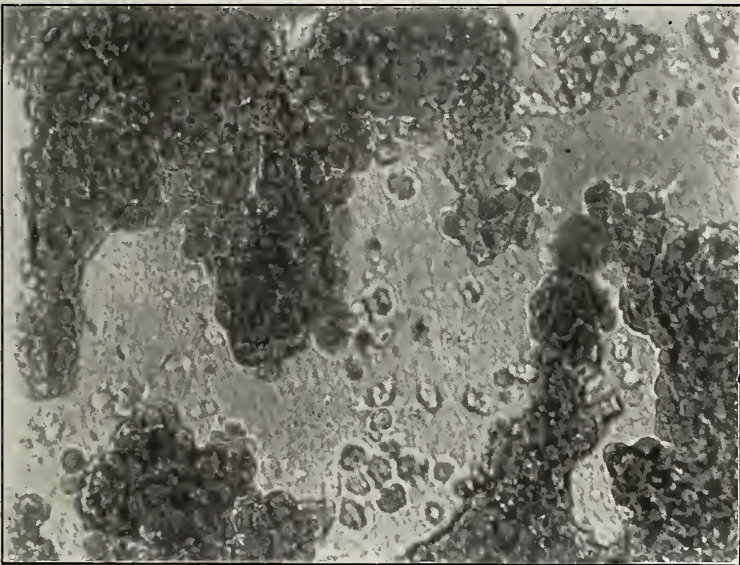


FIG. 116.—Dirt on the glass.



Blood poisoning similar to that shown on page 89. The man was very low from whom this was taken (a surgical case).



### A PECULIAR CASE.

From hearing others talk many people get the idea that this method of blood examination is one by which anything relating to the patient can be told. Instead of this it is merely an aid to the diagnosis of disease. Some years ago a bilious-looking man came to my office to have his blood examined. He said he had heard of me, that he came a good ways, had not much money, and therefore would like to explain what he wanted before he paid me, in order to see if I could satisfy him. He then said: "I am a painter by trade. My mother was a German and my father was a Frenchman, I am told. I seem to have two classes of friends—one among the colored race, the other among the white. Neither will own me. They both ridicule me and say I do not belong to them. Now, what I want you to tell me is whether I am a white man or a nigger. I do not know."

This was certainly a painful position, for the man was in earnest, and I was sorry to be obliged to inform him that I was unable to serve him.



## MISCELLANEOUS.





These are only a few of the odds and ends that I have taken from my photographic workshop.



## MISCELLANEOUS.

Bacilli (germs) in blood of person apparently healthy. (1-12 obj.) Fig. 117.

Swollen white blood cell. (1-12 obj.) Fig 118.

A plant in the blood of a man with advanced tuberculosis of the lungs—the ribbon shaped appearance. Fig. 119.

Pus and blood-cells, together with a large tailed cell filled with granules, in the lower middle of the picture. From a supposed hemorrhagic carcinoma of the cervix. Fig. 120.

Red blood-cell and fibrin highly magnified. One would think this was taken with a high power objective, from its size, but it was not. It was taken at night by the use of an artificial light. I had a box made 15 feet long, with proper arrangements at either end. I worked down cellar at one end, and a friend observed upstairs, at the ground glass end. On account of the crudeness of the apparatus, it was only practical to work in the middle of some stormy night. It was then dark. We could see these small baseballs floating across the thin ground glass plate. This picture was taken when the cell was in motion. Fig. 122. I also took photographs, which I still have, of the red cell, which measures 3 1-4 inches across. But these high magnifications are of no practical value; it is therefore useless to spend one's time on such work.

Cast from bronchial tube (sputum). Fig. 123.

Rotifer in Croton water. Taken as it was swimming across the field. Resembles a fish. Exposure instantaneous. Fig. 124.

A little animal often found on the skin when not cleaned. It is that which gets mixed with the blood as seen here. I have seen it taken for the echinococcus when seen in the urine. Fig. 125.

Pleurosigma angulatum 1-25 Tolles obj. Fig. 126.

Micro-motoscope picture of blood moving under the microscope, etc. Figs. 127-128-129. For description of instrument see page 367.





FIG. 117—1-12 obj. Harmless bacilli in the blood.

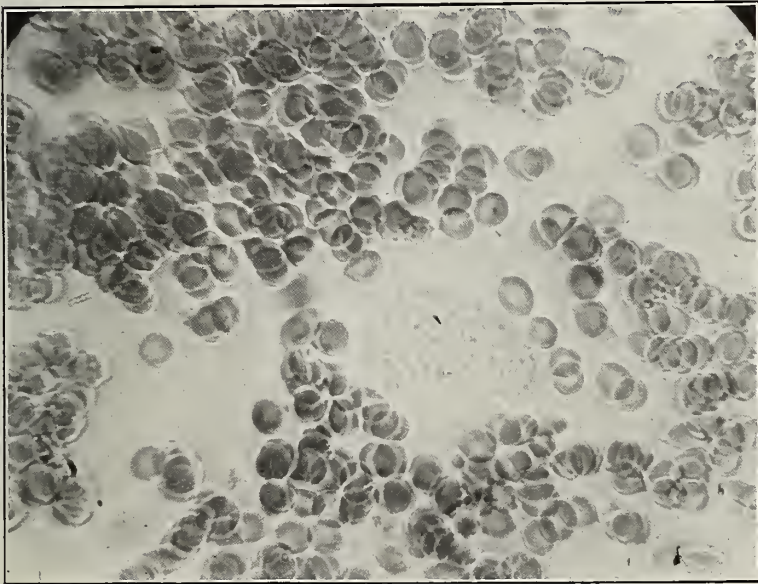


FIG. 118.—Swollen white cell filled with fat globules, etc.



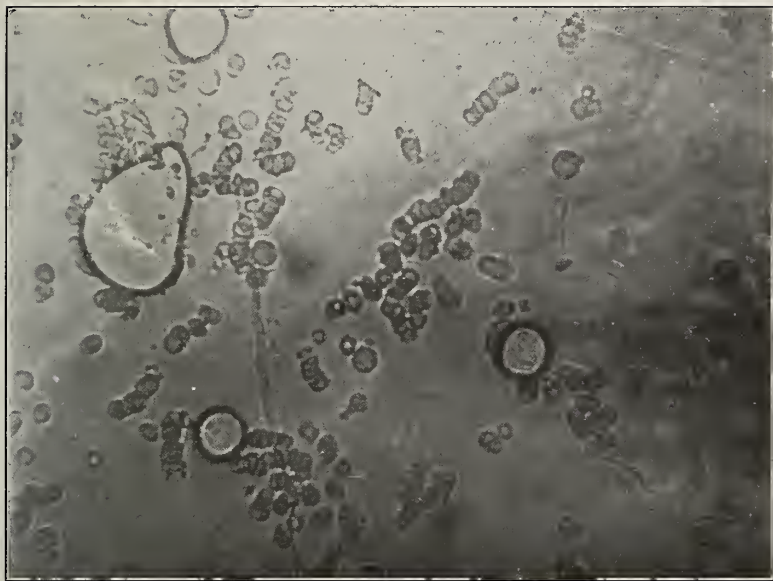


FIG. 119.—Plant in the blood—airbubbles. Patient, a sailor, was in Bellevue Hospital.

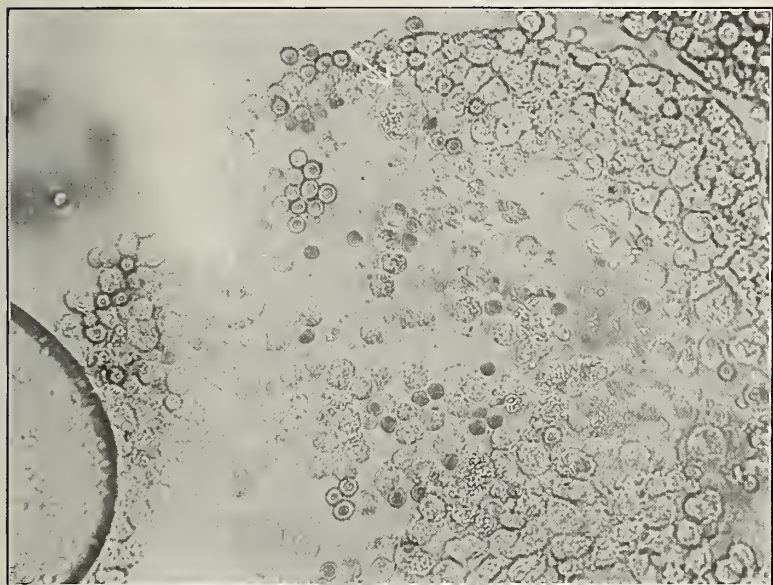


FIG. 120.—Cell with curled tail and double contour and granular contents proved to be from a uterine carcinoma, four years after this photo was taken. Specimen is discharged from the vagina.





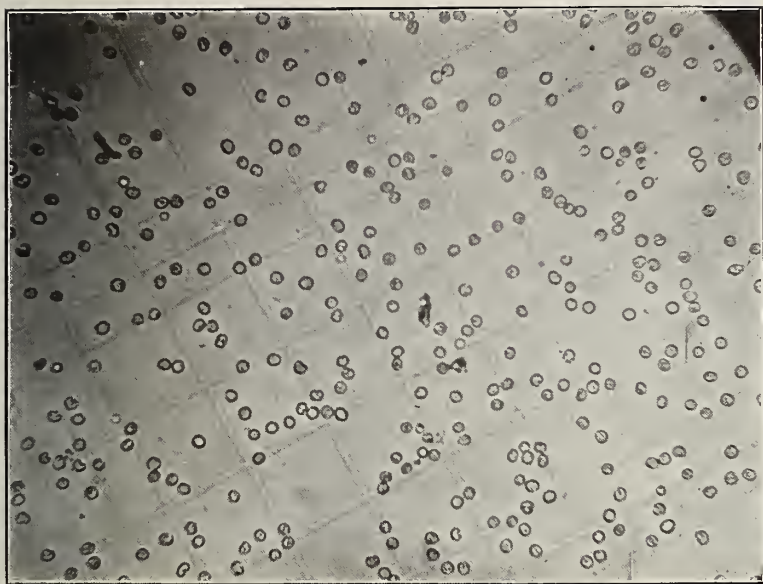


FIG. 121.—Diluted blood on the Thoma-Zeiss glass scale ready to count.  
See Leucocytosis.

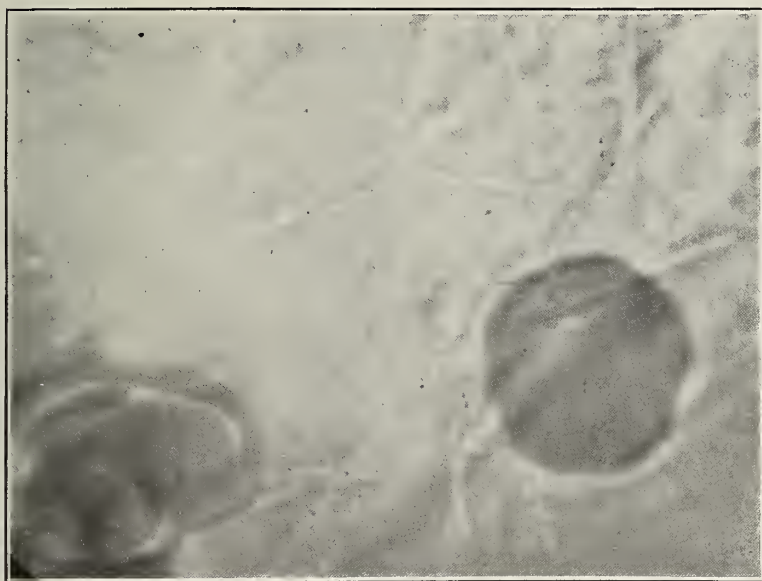


FIG. 122.—X 5,000. Large red corpuscle, fibrin, crypta syphilitica. (Large white speck on the fibrin.)





FIG. 123.—Cast from the bronchial tube.



FIG. 124.—1-6 obj. Rotifer from Croton water. Photo taken with ordinary camera as the small animal swam across the field.



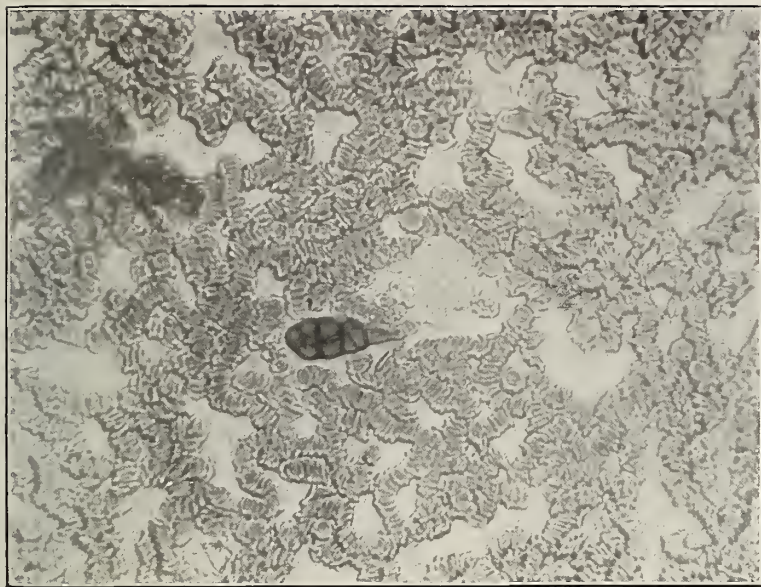


FIG. 125.—*Spharothae tyrae* (Moore). A plant probably from the skin, sometimes found in the blood.

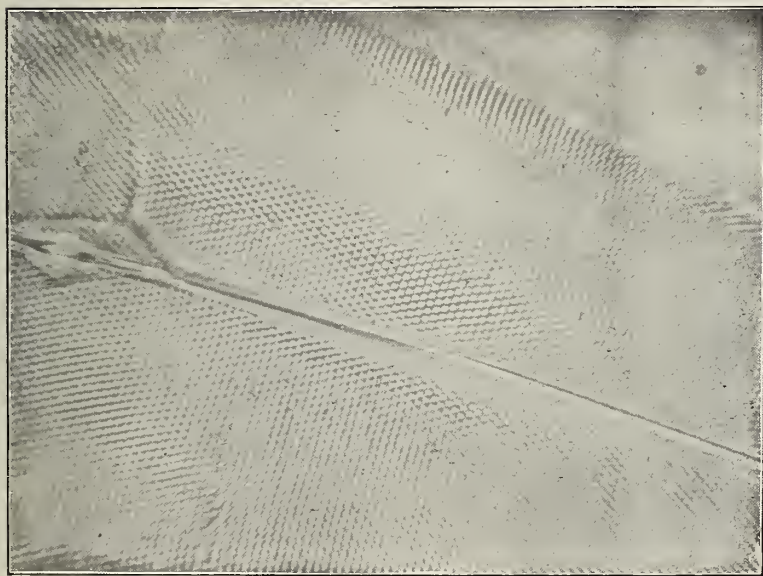


FIG. 126.—1-25 Tolles obj. *Plurosigma angulatum*.







FIG. 127.—1-12 obj. Germs on fermenting urine jumping about.

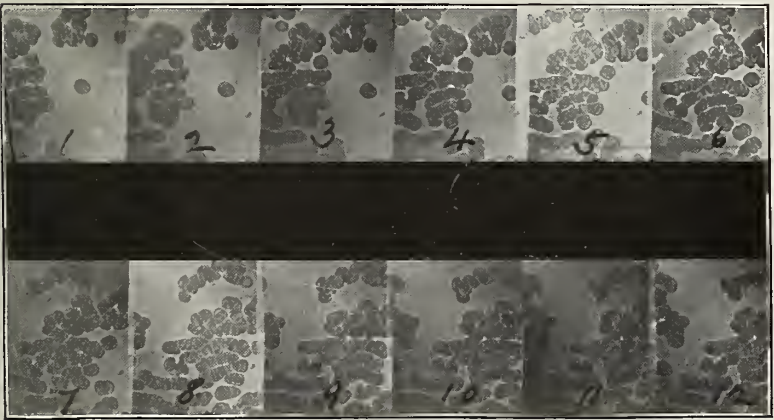


FIG. 128.—1-6 obj. Moving blood under the microscope.



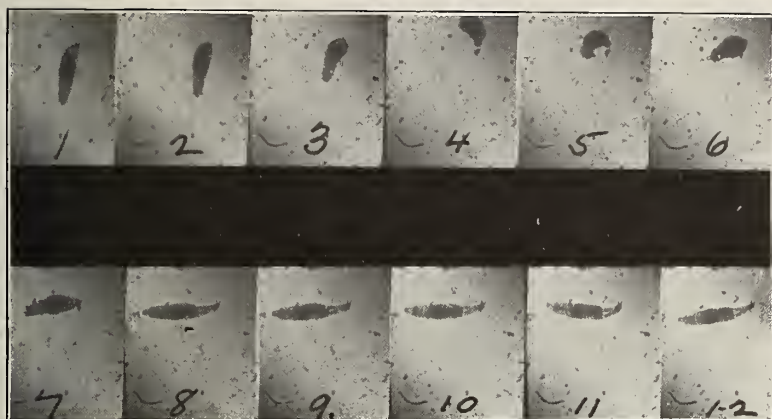


FIG. 129.—1-6 obj. Croton water rotifer feeding. When thrown on the screen the little animal can be seen to take in and throw out the food as he swims about.



FIG. 130.—Tubercle bacillus. Photograph taken from a case of Dr G. Lenox Curtis, in 1898.



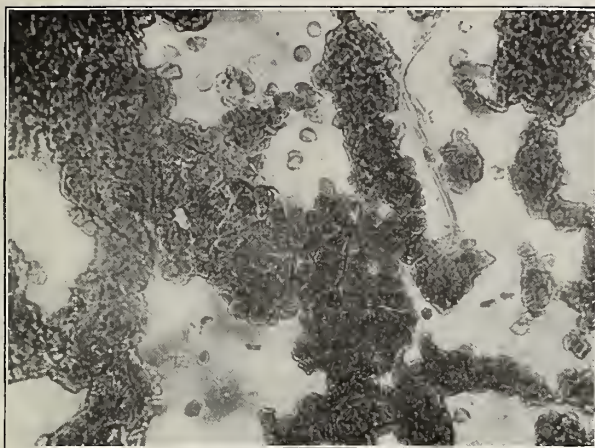


FIG. 133.—Upper right-hand corner is a string of cotton; looks like a thick piece of fibrin.

Rheumatic arrangement of red cells with the fibrin in the serum.

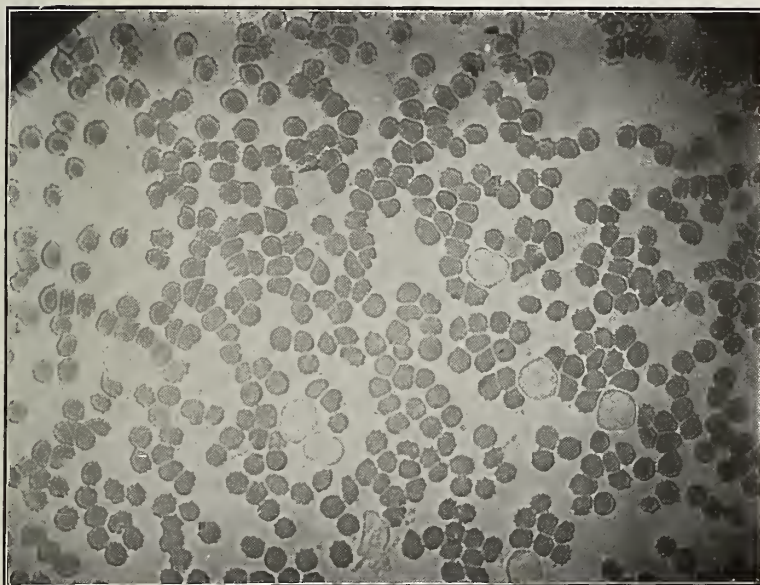


FIG. 134.—Abnormal number of white cells in the field. See Leucocytosis.



# THE MICRO-MOTOSCOPE.





## THE MICRO-MOTOSCOPE.

The micro-motoscope, as has been said, was gotten up with the idea of recording the changes that take place under the microscope in blood and reproduce them on the screen for the benefit of the student or investigator. It was found to work so successfully that it has been adapted to other cell changes and other microscopic life. It was recently demonstrated to a representative of the American Biograph Company, who, by this time, have probably improved on the original, and I understand, if the public are sufficiently interested, they intend to go into this line extensively. The author described the pictures taken with his apparatus in the "Scientific American" some years ago.

Some have desired the author to describe the apparatus, with drawings in detail; but such is unnecessary, for in the rough it is very simple; all that is necessary to do is to place a rapid picture-taking machine over the top of a microscope in a dark-room. Sunlight will do the work, but an electric enclosed arc lamp is the best; it takes a picture quicker than sunlight and it is the most easily manipulated.

It is better for this purpose to place the microscope in a horizontal position, putting the light in a dark box. If one desires to focus carefully and to watch the picture while it is being taken, a binocular microscope should be used, placing the camera over one tube and looking into the other.

Motion picture-taking machines are described under so many terms by different men that it is difficult to keep track of the names. The "Photograms" of 1897 calls the process kinetography. This periodical, in speaking of the micro-motoscope, says that "during the year two distinct steps have been made in kinetography." This editor then goes on to say that one was by Dr. Macintyre, of Glasgow, the other by Dr. R. L. Watkins, of New York. Dr. Macintyre combined kinetography and radiography and was able to reproduce the movement of the bones in the living

in the living limb. Dr. Watkins, on the other hand, combined kinetography and photomicrography, so as to be able to record and reproduce the movements of objects so small as corpuscles, rotifers, microbes. This power of studying the motion of the corpuscles is expected to prove of infinite value in the diagnosis of certain diseases. From this it will be seen that kinetography, which commenced as a scientific industry, has made distinct steps in scientific progress, in addition to captivating the public taste.

In the illustrations 12 pictures of each object are shown. In order to get the live motion on the screen from 12-16 of these pictures should be taken every second. In the book shown here there were 16 per second—i. e., 960 per minute.

See Figs. 127-128-129 on page 359.

# ANTI-TOXINE.



### ANTI-TOXINE.

This shows the effect of one dose of anti-toxine on the blood. The afflicted child had diphtheria of a severe type. The anti-toxine was injected as soon as the disease was recognized.

In a few hours paralysis of the vocal chords set in, but the child made a good recovery.





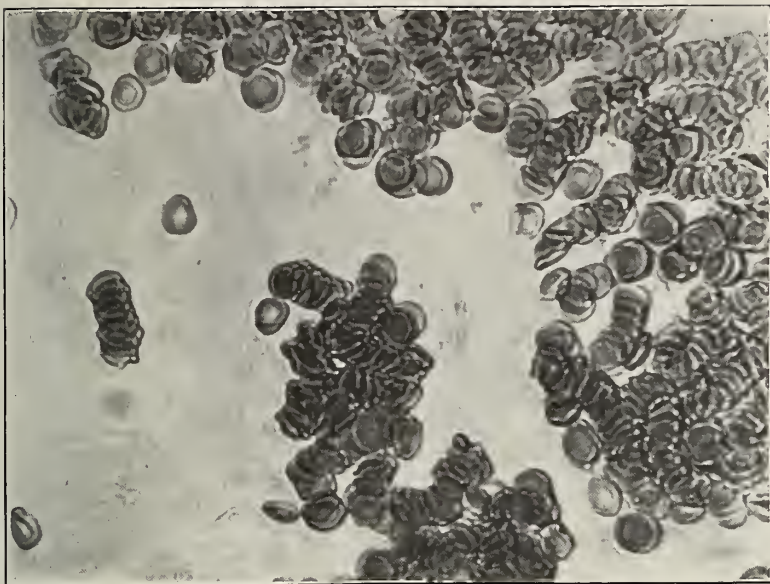


FIG. 135.—1-12 obj. Before using anti-toxine.

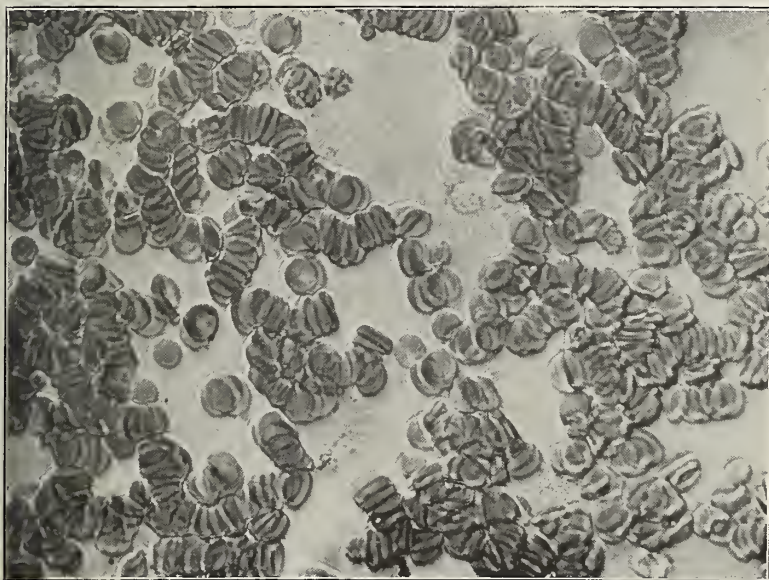


FIG 136.—After using anti-toxine. This photo was taken in 1896, when this preparation first came into use. Showing abnormal increase in thickness and quantity of the fibrin as it occurs in rheumatism.



## LAST REMARKS.



## LAST REMARKS.

The blood is now examined microscopically in every well regulated hospital, both in this country and in Europe. No physician can afford to neglect to examine the blood of his patient, for it will throw light on all diseases.

For examination of fresh blood, I would like to repeat the directions, because as much depends on the way the blood is drawn and placed on the slide as on the examination itself.

First, clean the wrist with either hot water or some anti-septic solution.

Second, make the prick there with a clean, sharp lance.

I prefer the one I have illustrated, because of the ease with which the operator can regulate the depth of the insertion and because it can be done so quickly that it will not be felt.

Third, squeeze the blood out of the wound. This is in order to get the fibrin, which floats near the wall of the blood vessels.

Fourth, place the cover glass in contact with the drop. It will adhere. Place this on the slide and examine.

There are some things that can most always be seen *by any one*.

In rheumatism you will always find the fibrin, and in tuberculosis the tuberculous matter, two of the diseases most often found in the practice of the physician. It is not the rare diseases in which the busy practitioner needs to be instructed so much as the common ones.

Examine for yourself, and never, except in special cases, examine dried blood; use it fresh.



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